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THE

OLUMBIAN ARITHMETIC,

DESIGNED FOR THE USE OF

ACADEMIES AND SCHOOLS.

BY M. [illegible] KERNEY, A.M.

[illegible]

Fifth Edition, Revised and Carefully Corrected, by

MEMBER OF THE SOCIETY OF THE HOLY CROSS

BALTIMORE:
BY JOHN MURPHY & CO.
BALTIMORE STREET.
[illegible]

YB 17394

THE

COLUMBIAN ARITHMETIC,

DESIGNED FOR THE USE OF

ACADEMIES AND SCHOOLS.

BY M. J. KERNEY, A. M.

Author of Compendium of Ancient and Modern History; First Class Book of History; Key, and Introduction to the Columbian Arithmetic, &c. &c.

25th Edition, Revised and Carefully Corrected, by

A BROTHER OF THE SOCIETY OF THE HOLY CROSS.

BALTIMORE:
PUBLISHED BY JOHN MURPHY & CO.
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1871.

Entered according to the Act of Congress, in the year 1849, by
M. J. KERNEY,
in the Clerk's Office of the District Court of Maryland.

Preface to the 20th Revised Edition.

Having used this work, in the Schools under my charge for the last twelve months, I soon became convinced of its peculiar adaptation to the wants of the Student, at the commencement, and during the continuance of his Arithmetical studies.

It aims above all others, at the most methodical arrangement, the clearest expositions, the best practical exercises, the most varied and useful applications—in all these respects presenting some new features, which have been adopted as improvements in the method of teaching this science.

Having discovered a few errors in its calculations, &c., at the solicitation of the Publishers, I have carefully revised and corrected the entire work. In the discharge of this duty I have been influenced as much by a desire to perpetuate the practical labors of the late Author, as to secure to the Youth of our country, one of the very best and most thoroughly practical Books, that have come under my notice.

I feel great pleasure and confidence in recommending it to Teachers as a work, from which the pupils will learn more in less time, and with greater ease than from any other similar work with which I am acquainted.

The Reviser.

Baltimore, *July*, 1862.

Author's Preface to the Tenth Edition.

When this work was compiled, the Author was engaged in teaching, and undertook the labor mainly for the benefit of his own school. His experience had long pointed out the necessity of a work in its department, better adapted to the wants of pupils, than any then in use. But while engaged in the preparation, he little anticipated that the work would meet with that degree of public favor, which has been so cordially extended to it. Several years have now elapsed since it first appeared; but time, the criterion of merit, has only added to its popularity, increased its circulation, and merited for it the favorable consideration of many eminent teachers.

In order to render the work still more deserving of those marks of approbation, the author has given the work a thorough and careful revision, and it is believed that the present edition will be found entirely free from any inaccuracies that may have appeared in the earlier editions. The author has not attempted in this work to develop any new principles in the science of figures; his sole object has been to produce a work that will supply the defects commonly met with in most of the arithmetics now in use. Elementary works on this subject have been of late years prepared by authors of eminent abilities; but as those authors, are, for the most part, men who have had but very little experience in teaching, their works treat too much of the theory of the science, without reducing it to practice.

Most of the arithmetics now used are very deficient in point of arrangement, and are very far from being practical in their application. In some, the rules and definitions are too concise, thereby throwing an additional burthen on the teacher to supply the deficiency; in others, the examples given to illustrate the rules, are badly selected, and are entirely without explanation.

The design, therefore, of the following work is to supply these defects, by presenting to the public a book of *practical* instruction; one in which the principles of the science are thoroughly explained and clearly elucidated. The arrangement of the work is entirely progressive; all questions being solved by rules previously explained. The examples for practice, are generally such, as the pupil will meet with in the various transactions of life. The rules and definitions are clear and concise, and the method of performing the operations explained; thus greatly abridging the labor of the teacher.

Questions have been inserted at the bottom of each page, for the convenience of the teacher in the examination of his pupils. Teachers, however, should not confine themselves rigidly to these questions, but vary them at pleasure; and in all cases they should require their pupils to understand the rules and principles on which they depend, and give the reason for the various steps by which they arrive at the result.

The liberal patronage heretofore extended to the work, is an agreeable admonition to the Author that his labors to facilitate the acquisition of the science of figures, have not been in vain; and while he is grateful for the past, he is encouraged to hope that the improved edition will meet with still greater favor, and merit a continuation of this patronage.

THE AUTHOR.

BALTIMORE, *August*, 1856.

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ARITHMETIC.

SECTION I.

Art. 1. Quantity is that property of any thing, which may be increased or diminished: as *time*, *extent*, *weight*, &c.

Unity or a *Unit*, is that by which every thing is regarded as *one*.

Numbers are the expressions of quantity; and

Arithmetic is the art of computing by numbers.

Art. 2. Any whole number is called an *integer*.

When the unit is applied to any particular thing it is called a *concrete* unit; and the numbers composed of concrete units, are called *concrete* numbers: as, *one dollar*. When no particular thing is indicated by the units, it is called an *abstract* unit: as, *three and three make six*.

Art. 3. A *composite* number is any number, which can be produced by multiplying two or more numbers together, each of which is greater than a unit. Thus, 16 is a composite number, being produced by multiplying 4 by 4.

A *factor* of any number is a name given to one of two or more numbers, which being multiplied together, will produce that number. Thus, 4 and 3 are factors of 12, because $4 \times 3 = 12$.

A *prime number*, is a number that cannot be produced by multiplying any two numbers together. Thus 1, 2, 3, 5, 7, 11, &c. are prime numbers.

Art. 4. The principal operations in arithmetic are those of *Notation*, *Numeration*, *Addition*, *Subtraction*, *Multiplication*, and *Division*.

Questions.—Art. 1. What is quantity? What is unity or a unit? What are numbers? What is arithmetic?—Art. 2. What is an integer? What is a concrete unit? An abstract unit?—Art. 3. What is a composite number? A prime number?—Art. 4. What are the principal operations in arithmetic?

NOTATION AND NUMERATION.

Art. 5. Notation is the art of expressing numbers by figures, or other characters; and

Numeration is the art of reading figures correctly.

There are two methods of notation; namely, the *Roman*, and the *Arabic* or Indian.

Art. 6. The Roman notation made use of *seven* capital letters, namely: I, for *one;* V, for *five;* X, for *ten;* L, for *fifty;* C, for *one hundred;* D, for *five hundred;* and M, for *one thousand.*

Numbers greater or less than a thousand are expressed by the use of these letters in various combinations: thus II express *two;* IV, *four;* VI, *six;* IX, *nine;* XV, *fifteen.* &c

Table of Roman Characters.

I	one.	XXIV	twenty-four.
II	two.	XXV	twenty-five.
III	three.	XXVI	twenty-six.
IV	four.	~~XXVII~~	~~twe~~nty-seven.
V	five.	XXVIII	twenty-eight.
VI	six.	XXIX	twenty-nine
VII	seven.	XXX	thirty.
VIII	eight.	XL	forty.
IX	nine.	L	fifty.
X	ten.	LX	sixty.
XI	eleven.	LXX	seventy.
XII	twelve.	LXXX	eighty.
XIII	thirteen.	XC	ninety.
XIV	fourteen.	C	one-hundred.
XV	fifteen.	CC	two-hundred.
XVI	sixteen.	CCC	three hundred.
XVII	seventeen.	CCCC	four hundred.
XVIII	eighteen.	D	five hundred.
XIX	nineteen.	DC	six hundred.
XX	twenty.	DCC	seven hundred.
XXI	twenty-one.	DCCC	eight hundred.
XXII	twenty-two.	DCCCC	nine hundred.
XXIII	twenty-three.	M	one thousand.

Questions.—Art. 5. What is notation and numeration? How many methods of notation?—Art. 6. What did the Roman notation make use of? How are numbers greater or less than a thousand expressed?

EXERCISE IN ROMAN NOTATION.

Let the pupil write in letters the following numbers:—

1. Nineteen. *Ans.* XIX.
2 Sixty-one.
3. Twenty-eight.
4. Forty-four.
5. Ninety-six.
6. Five hundred and fifty-two.
7. One thousand eight hundred and forty-nine.

ART. 7. The *Arabic* or Indian characters, now generally employed in Arithmetic, are ten in number, namely:

0,	1,	2,	3,	4,	5,	6,	7,	8,	9,
cypher,	one,	two,	three,	four,	five,	six,	seven,	eight,	nine.

Numbers higher than 9, are formed by writing two or more of the above characters together: as, 1 and 2, written together, make twelve;—thus 12 The value of figures, therefore, will depend upon the places which they occupy when written together, as the following table will show:

NUMERATION TABLE.

Quadrillions.	Hundreds of Trillions.	Tens of Trillions.	Trillions.	Hundreds of Billions.	Tens of Billions.	Billions.	Hundreds of Millions.	Tens of Millions.	Millions.	Hundreds of T.	Tens of Thou.	Thousands.	Hundreds.	Tens.	Units.
															1
														2	1
													3	2	1
												4	3	2	1
											5	4	3	2	1
										6	5	4	5	3	0
									7	6	5	4	6	2	5
								8	7	6	5	4	9	2	1
							9	8	7	6	5	4	8	4	2
						1	9	8	7	6	5	2	6	3	1
					2	1	9	8	7	6	5	2	5	4	5
				3	2	1	9	8	7	6	5	2	1	8	6
			4	3	2	2	8	6	7	5	8	5	4	2	1
		5	4	3	2	5	7	6	6	3	8	2	3	2	5
	6	8	4	3	2	6	7	4	2	4	5	4	7	6	5
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

QUESTIONS.—What are the characters used in Arithmetic? How are numbers higher than nine formed? On what will the value of figures depend?

ART. 8. The figures in the first column of the right hand of the above table, are *units;* those in the second, are *tens;* those in the third, *hundreds;* those in the fourth, *thousands,* &c.

Numbers from ten to one hundred, consist of two places of figures, namely *units* and *tens;* and they are formed in the following manner:

1	ten and	no units	make	10,	*Ten.*
1	ten and	1 unit	"	11,	*Eleven.*
1	" "	2 units	"	12,	*Twelve.*
1	" "	3 units	"	13,	*Thirteen.*
1	" "	4 units	"	14,	*Fourteen.*
1	" "	5 units	"	15,	*Fifteen.*
1	" "	6 units	"	16,	*Sixteen.*
1	" "	7 units	"	17,	*Seventeen.*
1	" "	8 units	"	18,	*Eighteen.*
1	" "	9 units	"	19,	*Nineteen.*
2	tens "	0 units	"	20,	*Twenty.*
2	" "	1 unit	"	21,	*Twenty-one.*
2	" "	2 units	"	22,	*Twenty-two.*
2	" "	2 units	"	23,	*Twenty-three.*
2	" "	5 units	"	25,	*Twenty-five.*
2	" "	9 units	"	29,	*Twenty-nine.*
3	" "	0 units	"	30,	*Thirty.*
3	" "	1 unit	"	31,	*Thirty-one.*
3	" "	2 units	"	32,	*Thirty-two.*
3	" "	8 units	"	38,	*Thirty-eight.*
4	" "	0 units	"	40,	*Forty.*
4	" "	4 units	"	44,	*Forty-four.*
4	" "	9 units	"	49,	*Forty-nine.*
5	" "	1 unit	"	51,	*Fifty-one.*
5	" "	6 units	"	56,	*Fifty-six.*
5	" "	9 units	"	59,	*Fifty-nine.*
6	" "	0 units	"	60,	*Sixty.*
6	" "	7 units	"	67,	*Sixty-seven.*
6	" "	8 units	"	68,	*Sixty-eight.*

QUESTIONS.—What are the figures in the right hand column? Those in the second, &c.? Of how many places of figures, do numbers from 10 to 100 consist?

ART. 9. To read numbers, commence on the right hand, and reckon towards the left, saying: *units*, *tens*, *hundreds*, *thousands*, *tens of thousands*, *hundreds of thousands*, *millions*, &c., until you have passed over all the figures in the number. As in the following example:

9	8	7	6	5	2	1
Millions.	Hund. of T.	Tens of T.	Thousands.	Hundreds.	*Tens.*	*Units.*

The number is then read from left to right in the following manner:

Nine million, eight hundred and seventy-six thousand, five hundred and twenty-one.

EXERCISE.

Let the pupils numerate the following numbers:

How many months in a year?	12
How many days in May?	31
How many days in a year?	365
Washington was born in the year	1732
Jackson was born in the year	1767
Columbus was born in the year	1442
Milton was born in the year	1608
Franklin was born in the year	1706

Read the population of the following States:

Maine,	501,793	North Carolina,	753,425
New Hampshire,	284,586	Virginia,	1,240,521
Maryland,	470,220	New York,	2,428,950

Write the following numbers in figures on the slate:

Twenty-five.
Eighty-six.
One hundred and two.
Six hundred and nine.
One thousand and ten.
Nine thousand and six.
Twenty-five thousand and one.
Three hundred and forty thous.
Nine hundred and ninety thous.
One million and one hundred.
One million, one thous. and one.
Nine million. *One billion.*

QUESTIONS.—How do you read numbers? What is the population of Maine, &c.

SECTION II.

SIMPLE ADDITION.

Art. **10.** Addition is that operation by which we find the sum of two or more given numbers.

When several figures are added together, the number they form is called the *sum*.

The sign of addition is generally represented by this character, +, which signifies *plus*, or that the two numbers or figures between which it is placed, are to be added together.

This character, =, is called the sign of equality, or *equal to*. Hence the expression $5 + 4 = 9$, is read 5 *plus* 4, is equal to 9.

Art. **11.** ADDITION TABLE.

1 and 0 are 1	5 and 0 are 5	9 and 0 are 9	11 and 0 are 11
1 and 1 are 2	5 and 1 are 6	9 and 1 are 10	11 and 1 are 12
1 and 2 are 3	5 and 2 are 7	9 and 2 are 11	11 and 2 are 13
1 and 3 are 4	5 and 3 are 8	9 and 3 are 12	11 and 3 are 14
1 and 4 are 5	5 and 4 are 9	9 and 4 are 13	11 and 4 are 15
1 and 5 are 6	5 and 5 are 10	9 and 5 are 14	11 and 5 are 16
2 and 0 are 2	6 and 1 are 7	9 and 6 are 15	12 and 1 are 13
2 and 1 are 3	6 and 2 are 8	9 and 7 are 16	12 and 2 are 14
2 and 2 are 4	6 and 3 are 9	10 and 0 are 10	12 and 3 are 15
2 and 3 are 5	6 and 4 are 10	10 and 1 are 11	12 and 4 are 16
2 and 4 are 6	6 and 5 are 11	10 and 2 are 12	12 and 5 are 17
3 and 0 are 3	7 and 0 are 7	10 and 3 are 13	12 and 6 are 18
3 and 1 are 4	7 and 2 are 9	10 and 4 are 14	12 and 7 are 19
3 and 2 are 5	7 and 5 are 12	10 and 5 are 15	12 and 8 are 20
4 and 1 are 5	8 and 0 are 8	10 and 6 are 16	12 and 9 are 21
4 and 2 are 6	8 and 2 are 10	10 and 7 are 17	12 and 10 are 22
4 and 4 are 8	8 and 5 are 13	10 and 8 are 18	12 and 12 are 24

Mental Exercise.

Art. **12.** 1. John has 3 cents and James 4; how many have they together?

2. A boy has 4 apples, and bought 2 more; how many had he then?

Questions.—What is addition? When several numbers are added together, what is the number they form called? How is the sign of addition made, and what does it signify?

3. Francis has 5 dollars, and John gave him 4 more; how many has he?

4. Paid 5 dollars for a barrel of flour, and 6 for beef; how much for both?

5. Paid 12 cents for a slate, and 8 for a copy-book; how much did they both cost?

6. A man lived 20 years in the city, and 10 in the county; how old is he?

7. If you receive 9 dollars from one man, and 8 from another; how many dollars have you?

8. Emily is 11 and Jane 9 years of age; what is the sum of their ages?

9. Paid 14 dollars for rent, and 10 for taxes; what is the whole amount?

10. An orchard contains 25 apple trees, 10 peach trees 10 pear trees, and 5 cherry trees; how many in all?

11. Thomas paid 10 cents for a knife, 12 for a pocket-book, and 5 for marbles; how much did he spend?

12. What is the sum of 5 and 2? 7 and 3? 6 and 3? 8 and 5? 9 and 6? 9 and 8? 12 and 10? 13 and 5? 14 and 7? 15 and 5? 16 and 6? 17 and 5? 18 and 3? 19 and 7? 20 and 7? 25 and 7? 29 and 4? 33 and 5? 36 and 8? 38 and 9? 40 and 20? 55 and 7? 60 and 20? 75 and 7? 98 and 9?

PRACTICAL ADDITION.

ART. **13.** In adding units, place the figures directly under each other, and then find the sum. For example:

In adding 1, 4 and 2 together they are placed thus.

$$\begin{array}{r}1\\4\\2\\\hline 7\end{array}\ \textit{the sum.}$$

In writing numbers, that consist of units, tens, hundreds, thousands, &c., the units must be placed under units, tens under tens, hundreds under hundreds, &c.

QUESTIONS.—In adding units, how do you proceed? In writing numbers that consist of units, tens, &c., how must the units, tens, &c., be placed?

Ex. 1. Let it be required to add together the following numbers: 1622, 131, 23 and 2.

1622
131
23
2
1778 *sum*

They are arranged in the following order, with units under units, tens under tens, hundreds under hundreds, &c.

Then commence with the units on the right hand column, and add them upwards, saying 2 and 3 are 5, 5 and 1 are 6, 6 and 2 are 8; write the 8 under the column of units. Then add up the column of tens, hundreds, &c., placing the sum of each under its respective column.

If the sum of figures in the column of units, tens, &c., amounts to ten or more than ten, write down the figure on the right hand, and *add* or carry left hand figure or figures to the next column; proceed in this way until you reach the last column, and then write down the whole amount of that column.

Ex. 2. Let it be required to add the following numbers: 9321, 887 and 72.

9321
887
72
10280

Write the numbers under each other, with units under units, tens under tens, &c. After adding up the the right hand column, we find it amounts to 10; write the cipher under the column of units, and carry or add the 1 to the column of tens, and say 1 to 7 are 8, 8 and 8 are 16, 16 and 2 are 18. again, write down the 8 and carry 1 as before.

ART. **14.** From the foregoing work, we deduce the following

RULE.

I. *Write the numbers under each other, so that units may fall under units, tens under tens, hundreds under hundreds, &c., and draw a line beneath them.*

II. *Commence at the bottom of the right hand column, and add up the figures in that column. If the sums of the figures*

QUESTIONS.—How do you commence the operation? If the sum of the figures in the column of units, &c., amount to ten or more, what do you do?

in this column be less than ten, write the whole sum under this column; but if their sum amount to ten or more than ten, write down the right hand figure and carry the left hand figure or figures to the next column. Proceed in like manner through all the columns, to the last, or left hand column, under which write the whole amount of last column.

Proof 1. Begin at the top and add the columns downwards in the same manner as they were added upwards; and if the two sums agree, the work is presumed to be correct. Or,

2. Separate the figures to be added into two parts by drawing a horizontal line between them. Add together the figures below the line, and to their sum add the figures above the line; and if their sum is equal to the first amount, the work is supposed to be correct.

Note.—The first method of proof is generally used in business.

Examples for Practice.

1. OPERATION.	2. OPERATION AND PROOF.	3. OPERATION
523	241	2534
462		1824
514	317	3462
120	520	3215
	913	
1619		11035
	1991	
	1750	
	1991	

4.	5.	6.	7.
151	234	472	187
213	512	316	501
321	151	102	520

Questions.—What is the rule for addition? What is the first proof The second proof? Which method is used in business?

8.	9.	10.	11.
1234	5652	9543	1045
5671	8246	1352	1528
3210	7321	5813	7102
5232	8715	7643	8084

What is the sum of 246, 356, 74 and 3? *Ans.* 679
What is the sum of 502, 612, 76 and 25? *Ans.* 1215
What is the sum of 931, 345, 5 and 1? *Ans.* 1282
Require the sum of 12, 187, 349 and 8? *Ans.* 556

APPLICATION.

1. I have two bills to collect, the one 21 dollars, and the other 15 dollars; how much have I to collect? *Ans.* 36 dollars.

2. A boy went to market and laid out 50 cents for beef, 25 cents for butter, 20 cents for apples, 14 cents for peaches and 10 cents for eggs; how much did he spend? *Ans.* 119 cents.

3. John bought a grammar for 25 cents, dictionary for 28, arithmetic for 31 cents, slate for 12 cents, and inkstand for 5 cents; how much did they all cost? *Ans.* 101 cents.

4. I have collected the rent of three houses for one month; the first 9 dollars, the second 15, and the third 18; how much did I collect? *Ans.* 42 dollars.

5. Paid 75 dollars for a horse, and 25 for a cart; how much do they come to? *Ans.* 100 dollars.

6. A certain orchard contains 48 apple trees, 35 peach trees, 25 cherry trees, 15 pear trees, and 6 plum trees? how many trees are in the orchard? *Ans.* 129

7. This school contains five classes: there are 35 boys in the first, 25 in the second, 21 in the third, 18 in the fourth, and 15 in the fifth; how many in all? *Ans.* 114.

8. A merchant bought six pieces of cloth; the first contains 48 yards, the second 39, the third 36, and each of the other two 28? how many yards did he buy? *Ans.* 207 yds.

9. A man bought a farm for 1850, paid for surveying 35 dollars, and paid interest on the principal 150 dollars; how much did the farm cost him? *Ans.* 2035 dollars.

10. A man bought a house, and paid for it, at one time 350 dollars, at another 475, at another 158, at another 325

dollars, and interest thereon, 195 dollars; what did it cost him? *Ans.* 1503 dollars

11. Gave 18 dollars for a coat, 4 for a vest, and 6 for a hat what is the amount of my bill? *Ans.* 28 dollars

12. Florida had 54,477 inhabitants, Wisconsin 30,945, Iowa 43,112, and the District of Columbia 43,712; how main all? *Ans.* 172,246.

13. I paid to one man 29 dollars, to another 36, to a third 43, and to a fourth 9; how much money did I pay?

14. A man collected five bills, as follows: the first 13 dollars, the second 9, and each of the rest 15 dollars; what was the amount of his collections?

15. A certain manufacturing establishment expended in one month 19,486 dollars; now, if it were to expend an equal sum for six successive months, what would be the whole amount of its expense for that time?

SECTION III.

SIMPLE SUBTRACTION.

ART. **15.** SUBTRACTION is that operation which teaches the method of finding the difference between two numbers.

The numbers to be subtracted must be of the same kind; for example, we cannot subtract 2 dollars from 5 feet, because they are of different kinds or species.

In simple subtraction, one of the numbers must always be equal to, or greater than the other; as *a greater number cannot be taken from a less.*

ART. **16.** The greater number is called the *Minuend;* and the less number, or the number to be subtracted, is called the *Subtrahend;* and the answer, or number formed by this operation, the *Difference* or *Remainder.*

QUESTIONS.—Art. 15. What is simple subtraction? What must numbers to be subtracted be? In simple subtraction what is further observed? Art. 16. What is the greater number called? The less The answer?

The sign of subtraction is made thus, —, which is called *minus* or *less;* and when placed between two numbers, it signifies that the number *following* it is to be taken from the one that *precedes* it: as 6 — 4 = 2.

ART. 17. MENTAL EXERCISES IN SUBTRACTION.

1. Henry had five oranges, and gave two of them to John; how many has he left?
2. Thomas had four marbles, and lost two of them; how many has he left?
3. A man had nine dollars, and paid away six; how many has he left?
4. Peter had twelve cents, and spent seven of them; how many had he left?
5. From fifteen dollars, I paid nine; how many had I left?
6. Emily had twenty-five cents, gave ten of them for a thimble? how many has she left?
7. John is thirteen years old, and Henry eight; what is the difference between their ages?
8. Francis had ten cakes, and gave his brother three; how many has he left?
9. Daniel had eleven apples, and sold five; how many has he left?
10. Edward had twelve apples; he gave three to Jane and four to Emily; how many had he left?
11. How many are 4 less 1? 4 less 2? 4 less 3? 4 less 4?
12. How many are 7 less 3? 7 less 5? 7 less 2? 7 less 4?
13. How many are 9 less 5? 11 less 6? 12 less 7? 13 less 6?
14. How many are 16 less 12? 19 less 5? 17 less 5? 15 less 6?
15. How many are 18 less 3? 25 less 6? 30 less 10?
16. How many are 27 less 6? 29 less 7? 28 less 12? 41 less 20?

ART. 18. If the figure in the *minuend* be less than the figure under it, in the *subtrahend,* ten must be added to the upper figure, and the under figure subtracted from the amount, and one must be carried to the next figure in the subtrahend.

QUESTIONS.—Art. 18. If the figure in the number be less than that under it in the subtrahend, what do you do? Explain the operation in the given example.

Ex. Let it be required to subtract 893 from 1235.

1235 *Minuend.*
893 *Subtrahend.*
———
342 *Remainder.*

Write the less number under the greater, units under units, tens under tens, &c., and draw a line under them. Then begin with the units, and take 3 from 5, and 2 remain, which must be placed under the units.

But we cannot take 9 from 3, because it is greater than 3; therefore we borrow 1 from the hundreds of the *minuend*, which is the same as 10 tens; this being added to 3 tens, will make 13; and now taking 9 from 13, 4 will remain, which remainder we write under the column of the tens, and carry 1 to the next figure in the subtrahend, and then say, 1 added to 8 makes 9, and 9 from 12 leaves 3, which must be written under the column of the hundreds. Hence, 342 is the true remainder.

From the preceding operation we have the following

RULE.

I. *Write the less number under the greater, placing units under units, tens under tens, &c., and draw a line under them.*

II. *Begin with the units on the right, and take the lower figure from the figure directly over it, and place the difference under that figure.*

III. *If the upper figure be less than the lower figure, add* 10 *to the upper figure, and subtract the lower figure from the sum; place the difference between them under that figure, and carry* 1 *to the next figure in the subtrahend.*

Proof.—Add the remainder and the subtrahend together, and their sum will be equal to the minuend, if the work be correct. Or,

Subtract the remainder from the minuend, and the result will be the subtrahend, if the work be correct.

Questions.—What is the rule for simple subtraction? What is the proof?

EXAMPLES FOR PRACTICE.

	1.	2.	3.
	OPERATION.	OPERATION AND PROOF.	OPERATION AND PROOF
Minuend	376	978	547
Subtrahend	167	154	376
Remainder	209	824	171
		Minuend, 978	*Subtrahend*, 376

	4.	5.	6.	7.
From	9876	1249	15354	9871
Take	7354	976	8953	7798

8. From 671111 take 199999? *Ans.* 471112.
9. From 158701 take 98731? *Ans.* 59970.
10. From 83119 take 5398? *Ans.* 77721.
11. From 11678 take 9283? *Ans.* 2395.
12. From 2873 take 965? *Ans.* 1908.

EXAMPLES FOR PRACTICE.

1. John owed his brother 6 dollars and paid him 4; what does he owe him yet? *Ans.* 2 dollars.

2. From a bill of 85 dollars, I have paid 70; how much do I owe yet? *Ans.* 15 dollars.

3. Bought 36 bushels of apples, and sold 18; how many bushels remain? *Ans.* 18 bushels.

4. A man bought 125 gallons of molasses, and sold 99; how many gallons has he left? *Ans.* 26 gallons.

5. A man bought 185 gallons of wine, but by accident he lost 97 gallons; how many gallons has he yet? *Ans.* 88 galls

6 A owes B 1,728 dollars, and pays him 961 dollars; how much does he still owe him? *Ans.* 767 dollars

7. Our national independence was declared in the year 1776; how many years to the present time?

8. A man engaged to remove 1,135 barrels of flour, and after he had removed 987, how many remained? *Ans.* 148 barrels.

9. A merchant bought 14 casks of wine, containing 1,158 gallons, and sold 9 casks containing 736 gallons; how many casks and gallons remained? *Ans.* 5 casks and 422 gallons

10. Bought a quantity of coffee for 5,873 dollars, and sold it for 7,325 dollars; how much was gained?
Ans. 1,452 dollars.

11. A man was born in 1737 and died in 1832; how old was he? *Ans.* 95 years.

12. A person bought goods to the amount 18,963 dollars, at six months credit; but by paying cash for them a deduction of 295 dollars was made; what sum did he pay?
Ans. 18,668 dollars.

13. In the year 1800 the population of Pennsylvania was 602,545, and in 1840 it was 1,724,033; what was the increase? *Ans.* 1,121,488.

14 From one million take 11? *Ans.* 999,989.

15. New York has 312,710 inhabitants and Boston 93,383; what is the difference of their populations? *Ans.* 219,327.

ART. 19. EXERCISE IN ADDITION AND SUBTRACTION

1. Add together 8, 7, 9, 3, 5 and 4; and from their sum subtract 25? *Ans.* 11.

2. If I add together 15, 18, 29, 87, and 34 dollars, and from this sum subtract 99 dollars; what sum remains?
Ans. 84 dollars.

3. A man owed me four bills of 16, 15, 36 and 18 dollars, and paid 36; how much does he owe yet? *Ans.* 49 dollars.

4. A person was indebted to his tailor for a coat, 18 dollars, pantaloons 8 and vest 5, and paid him 25; what sum does he still owe? *Ans.* 6 dollars.

5. A merchant bought four casks of wine, the first contained 85 gallons, the second 73, the third 62, and the fourth 59, and sold 198 gallons; how many gallons remain?
Ans. 81 gallons.

6. Bought a house for 2,465 dollars, paid for repairing 168, recording 6, and taxes 25, and sold it for 2,983 dollars; what did I gain? *Ans.* 319 dollars.

7. A person left 2000 dollars to be divided between his five children; the first was to receive 500 dollars, the second 450, the third 387, the fourth 300; what did the fifth receive? *Ans.* 363 dollars

8. A man owns 3,802 acres of land, and gave 1,001 acres to his son, 902 acres to two daughters each; how many acres were left? *Ans.* 997 acres.

SECTION IV

MULTIPLICATION

Art. 20. Multiplication is a short method of performing addition. The number to be multiplied is called the *Multiplicand.* The number by which it is multiplied is called the *Multiplier;* and the result of the operation is called the *Product.* The sign used in multiplication is made thus, ×; and when placed between numbers signifies that they are to be multiplied together: as, $4 \times 3 = 12$.

Art. 21. The *multiplication table* contains the products of numbers from 1 to 12.

MULTIPLICATION TABLE.

Twice		3 times		4 times		5 times		6 times		7 times	
1 make	2	1 make	3	1 make	4	1 make	5	1 make	6	1 make	7
2	4	2	6	2	8	2	10	2	12	2	14
3	6	3	9	3	12	3	15	3	18	3	21
4	8	4	12	4	16	4	20	4	24	4	28
5	10	5	15	5	20	5	25	5	30	5	35
6	12	6	18	6	24	6	30	6	36	6	42
7	14	7	21	7	28	7	35	7	42	7	49
8	16	8	24	8	32	8	40	8	48	8	56
9	18	9	27	9	36	9	45	9	54	9	63
10	20	10	30	10	40	10	50	10	60	10	70
11	22	11	33	11	44	11	55	11	66	11	77
12	24	12	36	12	48	12	60	12	72	12	84

8 times		9 times		10 times		11 times		12 times	
1 make	8	1 make	9	1 make	10	1 make	11	1 make	12
2	16	2	18	2	20	2	22	2	24
3	24	3	27	3	30	3	33	3	36
4	32	4	36	4	40	4	44	4	48
5	40	5	45	5	50	5	55	5	60
6	48	6	54	6	60	6	66	6	72
7	56	7	63	7	70	7	77	7	84
8	64	8	72	8	80	8	88	8	96
9	72	9	81	9	90	9	99	9	108
10	80	10	90	10	100	10	110	10	120
11	88	11	99	11	110	11	121	11	132
12	96	12	108	12	120	12	132	12	144

Note.—This table should be carefully committed to memory; while the pupils are engaged in learning the table, they may be exercised in the following mental operations with great advantage.

Questions.—Art. 20. What is multiplication? What is the number to be multiplied called? The number by which it is multiplied The result of the operation? How is the sign of multiplication made and what does it signify?—Art. 21. What is the multiplication table?

ART. 22. MENTAL EXERCISE IN MULTIPLICATION.

1. If 1 orange cost 5 cents, what will 3 oranges cost?

2. What will 5 apples cost at 2 cents a piece?

3. What is the product of 4 and 3? of 5 and 4? of 7 and 3? of 8 and 2? of 5 and 6?

4. If a quart of cherries cost 6 cents, what will four quarts cost?

5. If a bushel of wheat cost 2 dollars, what will 9 bushels cost?

6. If a pair of boots cost 4 dollars, what will 7 pair cost?

7. If there are 9 feet in a square yard, how many feet in 3 yards? In 4 yards? 5 yards? 6 yards? 8 yards?

8. If a pound of sugar cost 6 cents, how many cents will 4 pounds cost? 6 pounds? 7 pounds? 8 pounds? 9 pounds? 10 pounds? 11 pounds? 12 pounds?

9. If a man earn 7 dollars a week, what will he earn in 8 weeks?

10. If in one penny there are 4 farthings, how many in 8 pence? In 9 pence? 7 pence? 5 pence?

11. If 12 pence make a shilling, how many pence in 2 shillings? In 3 shillings? In 4 shillings? In 5 shillings? In 6 shillings? In 7 shillings? In 12 shillings?

12. If one cord of wood cost 4 dollars, what will 6 cords cost? 7 cords? 8 cords? 9 cords? 12 cords?

13. If a yard of cloth cost 3 dollars, what will 5 yards cost? 7 yards? 9 yards? 10 yards? 11 yards? 12 yards?

14. What will 11 cwt. of sugar cost, at 8 dollars per cwt.?

15. What will 9 tons of iron cost at 9 dollars per ton? What will 7 tons cost at the same rate? 10 tons? 12 tons? 3 tons? 8 tons? 6 tons?

CASE I.

When the multiplier is twelve or less.

ART. 23. The following is the method of performing the operation when the multiplier does not exceed 12.

Ex. 1. Let it be required to multiply 132 by 3.

1 3 2 *Multiplicand.*
3 *Multiplier.*

3 9 6 *Product.*

After writing the multiplier under the units of the multiplicand, draw a line under them Then multiply the 2 of the multiplicand by 3, saying 3 times 2 are 6, and set down the 6 directly under the 3. Then say again, 3 times 3 are 9, and write the 9 under the tens of the multiplicand; and lastly, 3 times 1 are 3, which place under the hundreds of the multiplicand, and the product is 396.

Ex. 2. Again let it be required to multiply 6543 by 5.

6 5 4 3 *Multiplicand.*
5 *Multiplier.*

3 2 7 1 5 *Product.*

Write the 5 under the units of the multiplicand as before, and then say, 5 times 3 are 15; set down 5 in the units' place, and carry or reserve in the mind the 1 ten, which must be added to the next product. Then multiply 4 by 5, and the product is 20, to this we add the 1 reserved in the mind, and it makes 21; write down the 1 and carry the 2, and say 5 times 5 are 25, to this add the 2 carried, and it makes 27; lastly, multiply 6 by 5, and the product is 30; to this again, add the 2 carried, and the sum is 32, which write down in full. Hence the true product is found to be 32715.

From the above operation we derive the following rule for multiplication, when the multiplier does not exceed 12

ART. 24. RULE.

I. *Write the multiplier under the multiplicand, with units under units, and tens under tens.*

II. *Then multiply successively the units, tens, hundreds, &c., of the multiplicand by the multiplier, and place the products, if less than ten, respectively under the units, tens, hundreds, &c., of the multiplicand. But if the product exceeds* 9, *set down the units and carry the tens to the next product.*

PROOF.—Multiplication may be proved by different methods.

QUESTIONS.—Art. 23. Explain the operation in the first example? Explain the operation in the second?—Art. 24. What is the rule

1. By writing down the multiplicand as many times as there are units in the multiplier, and adding up the column; if the work be correct, the sum will be equal to the product.

2. Divide the product by the multiplier, and the quotient will be equal to the multiplicand, if the work be correct.

3. Multiply the multiplier by the multiplicand, and if the result be the same as the first product, the work may be supposed to be correct.

Ex. 1. Let it be required to multiply 7432 by 3.

	OPERATION.		PROOF BY FIRST METHOD
Multiplicand	7432		7432
Multiplier	3		7432
			7432
Product	22296		
		Product	22296

Note.—The above methods of proof may be found very convenient, particularly when the multiplier and multiplicand are not very large; but the following rule for proving the correctness of multiplication, will be found infallible and easy.

Multiply by one less than the number of units in the multiplier; then add the multiplicand to the product, and if the work be correct, the sum will be the same as that of the multiplicand multiplied by the entire multiplier.

Ex. 2. Let it be required to multiply 25 by 5.

	OPERATION.		PROOF.
	25		25
	5		4
Product	125		100
			25
		Product	125

In this example we multiplied 25 by 5 and the product is 125: and in the proof we multiplied 25 by 4, that is, one less than the multiplier, and to the product we added 25, the multiplicand, and we found the sum to be equal to the first product, which proves the work to be correct.

EXAMPLES FOR PRACTICE.

1. Multiply 65431 by 2? *Ans.* 130862.

Questions.—What are the different methods of proving work in multiplication? In the *note*, what rule is given for proof? Explain the example?

2. Multiply 74323 by 3? *Ans.* 222969
3. Multiply 53212 by 4? *Ans.* 212848
4. Multiply 65421 by 5? *Ans.* 327105.
5. Multiply 98732 by 6? *Ans.* 592392.
6. Multiply 7643 by 7? *Ans.* 53501.
7. Multiply 852 by 8? *Ans.* 6816.
8. Multiply 732 by 9? *Ans.* 6588.
9. Multiply 95 by 10? *Ans.* 950.
10. Multiply 52 by 11? *Ans.* 572.
11. Multiply 65 by 12? *Ans.* 780.
12. Multiply 9 by 12? *Ans.* 108.

APPLICATION.

1. What will 15 pounds of sugar come to, at 5 cents per pound? *Ans.* 75 cents.

2. What will 18 yards of muslin cost, at 8 cents per yard? *Ans.* 144 cents.

3. At 4 dollars per dozen, what will 425 dozen of knives cost? *Ans.* 1700 dollars.

4. At 78 cents per day, what will a man earn in 9 days? *Ans.* 702 cents.

5. Bought 1872 pounds of bacon, at 9 cents per pound, what sum will pay for it? *Ans.* 16848.

6. At 8 dollars per day, what will a man earn in 365 days? *Ans.* 2920 dollars.

7. What will a man spend in 365 days for tobacco, at 4 cents per day? *Ans.* 1460 cents.

8. What will a daily paper come to in 52 weeks, at 6 cents per week? *Ans.* 312 cents.

9. A grocer sold 5456 cwt. of sugar, at 9 dollars per cwt., how many dollars did he receive? *Ans.* 49104 dollars.

10. What is the value of 13438 barrels of flour, at 6 dollars per barrel? *Ans.* 80628 dollars.

11. Bought 5 pieces of cloth, each piece containing 35 yards, what sum will pay for them, at 4 dollars per yard? *Ans.* 700 dollars.

12. Sold 1875 acres, for 11 dollars per acre, what sum will pay for them? *Ans.* 20625 dollars.

13. What will 9125 pounds of cheese come to, at 8 cents per pound? *Ans.* 73000 cents.

14. What is the cost of 150 reams of paper, at 2 dollars per ream? *Ans.* 300 dollars

15. If a vessel sails at the rate of 10 miles per hour, how far will it sail in 7846 hours? *Ans.* 78460 miles.

16. Sold 186742 pounds of lead, for 5 cents per pound, what sum will pay for it? *Ans.* 933710 cents.

17. At 9 cents a quart, what will 99 quarts of molasses cost?

18. At 12 cents a bushel, what will 75832 bushels of ice come to?

CASE II.

ART. **25.** *When the multiplier is greater than* 12.

EX. Let it be required to multiply 763 by 24.

Multiplicand	763
Multiplier	24
	3052
	1526
Product	18312

Here we write the multiplier under the multiplicand, with units under units and tens under tens, and then proceed to multiply the multiplicand by 4, as directed in Case 1st. Secondly, we multiply each figure in the multiplicand, by the tens of the multiplier, saying, twice 3 are 6, which we place under the tens of the multiplier; and twice 6 are 12; again we write the 2 under the hundreds of the multiplier, and carry the 1. Lastly, having multiplied the 7 by 2, and adding the one we carried, the sum is 15. Draw a line, and add these two products together, and we have the full product of 763 by 24, equal to 18312.

ART **26.** From the above operation we deduce the following

RULE.

I. *Write the multiplier under the multiplicand, placing units under units, tens under tens, &c., as in the first case, and draw a line under them.*

II. *Then commencing with the units, multiply each figure in the multiplicand, by every figure in the multiplier and place the* *first figure of each product directly under its multiplier, observing to carry the tens as in the former case.*

III. *Lastly draw a line, and add together the several products in the order in which they stand; and their sum will be the true product required.*

NOTE.—For the *proof* of the correctness of the work, see Case I, ART 24.

EXAMPLES FOR PRACTICE.

	1.	2.
Multiply	1525	54321
By	23	35
	4575	271605
	3050	162963
Ans.	35075	1901235

3.	4.
156789	9876553
43	47

5. Multiply 15 by 14?	*Ans.* 210.
6. Multiply 25 by 18?	*Ans.* 450.
7. Multiply 125 by 23?	*Ans.* 2875.
8. Multiply 168 by 41?	*Ans.* 6888.
9. Multiply 325 by 52?	*Ans.* 16900.
10. Multiply 643 by 87?	*Ans.* 55941.
11. Multiply 2526 by 136?	*Ans.* 343536.
12. Multiply 52365 by 543?	*Ans.* 28434195.

APPLICATION

1. What will 32 tons of iron cost at 25 dollars per ton?
Ans. 800 dollars

2. What will 175 acres cost, at 16 dollars per acre?
Ans. 2800 dollars.

QUESTIONS.—Explain the example? What is the rule, when the multiplier is greater than 12?

3. What will 36 yards of linen cost, at 62 cents per yard? *Ans.* 2232 cents.

4. What will 144 pounds of tea cost at 75 cents per pound? *Ans.* 108 dollars

5. Bought 862 pounds of lard, at 14 cents per pound, what will it amount to? *Ans.* 12068 cents.

6. If one acre cost 36 dollars, what will 650 acres cost? *Ans.* 23400 dollars.

7. What will 38 tons of hay cost, at 18 dollars per ton? *Ans.* 684 dollars.

8. What will 94 bushels of oats cost, at 36 cents per bushel? *Ans.* 3384 cents.

9. What will 875 barrels of pork come to, at 16 dollars per barrel? *Ans.* 14000 dollars

10. If a vessel sail 196 miles in one day, how far will she sail in 125 days? *Ans.* 24500 miles.

11. If a man travel 32 miles in one day, how many will he travel in 95 days? *Ans.* 3040 miles.

12. If one quire of paper contains 24 sheets, how many sheets in a ream, which consists of 22 quires? *Ans.* 528 sheets.

13. A certain factory produces 786 yards per day, how many yards will be made in 313 days? *Ans.* 246018 yards.

14. A regiment of soldiers consists of 1128 men, how many men in an army of 36 regiments? *Ans.* 40608 men.

15. If one hogshead of sugar contains 873 pounds, how many pounds in 83 hogsheads? *Ans.* 72459 pounds.

16. What will 4 firkins of butter, each 36 pounds, cost at 25 cents per pound? *Ans.* 36 dollars

17. Bought 18 bales of cloth, in each bale 25 pieces, and in each piece 28 yards; how many pieces and yards?

18. What will 542 yards of linen cost, at 87 cents per yard?

19. What will 35 horses cost, at 95 dollars each?

20. There are 24 hours in one day, how many hours in 365 days?

ART. 27. A short method of multiplying, when ciphers occur on the right of the multiplier.

Ex. In 1 foot there is 12 inches; how many inches in 10 feet? In 100 feet?

OPERATION.

Multiplicand	1 2	1 2
Multiplier	1 0	1 0 0
Product	1 2 0	1 2 0 0

Multiplying by one never changes the value of any number. But if we annex a cipher, it is the same as multiplying by ten; because it removes the units of the multiplicand to the place of the tens. Again, if two ciphers be annexed to the multiplicand, each figure is removed two places to the left, and its value is increased 100 times, or multiplied by 100. So for any number of ciphers. Hence we have the following *rule* for multiplying by 10, 100, 1000, &c.

RULE.

Add the cipher or ciphers to the multiplicand.

EXAMPLES FOR PRACTICE.

1. Multiply 25 by 10? *Ans.* 250.
2. Multiply 583 by 100? *Ans.* 58300.
3. Multiply 520 by 1000? *Ans.* 520000.
4. Multiply 7 by 10000? *Ans.* 70000.
5. If one pound of lard cost 9 cents, what will 10 pounds cost? *Ans* 90 cents
6. What will 25 acres cost, at 100 dollars per acre? *Ans.* 2500 dollars.

ART. **28.** When the multiplier or multiplicand consists of figures higher than 1, with the ciphers annexed to the right.

RULE.

Multiply by the significant figures, and add the cipher or ciphers to the product.

EXAMPLES FOR PRACTICE.

1. Multiply 125 by 20? *Ans.* 2500.
2. Multiply 548 by 30? *Ans.* 16440.

QUESTIONS.—Art. 27. What is the rule for multiplying by 10, 100, &c.?—Art. 28. What is the rule for multiplying, when the multiplier or multiplicand, consists of figures higher than one, with ciphers annexed?

3 Multiply 987 by 40? *Ans.* 39480.
4. Multiply 1786 by 600? *Ans.* 1071600.
5. Multiply 8732 by 9000? *Ans.* 78588000.
6. What will 5 horses cost at 80 dollars each? *Ans.* 400.
7. What will 135 acres cost at 60 dollars per acre. *Ans.* 8100.
8. If 20 dollars be given for 1 cwt. of iron, what will 900 cwt. cost? *Ans.* 18000.
9. In one dollar there are 100 cents, how many cents in 1500 dollars?

ART. **29.** When ciphers occur in any part of the multiplier.

RULE.

Pass them over, and go to the next figure of the multiplier.

Ex.—Multiply	125	1235
By	105	1005
	625	6175
	125	1235
Product	13125	1241175

In the first example, after multiplying all the figures in the multiplicand by five, the units of the multiplier, we pass over the cipher, and multiply by the 1; then draw a line and add up as before. In the second example, after multiplying by 5 the units of the multiplier, we pass over the two ciphers, and multiply by the 1. Proceed in like manner with any number of ciphers that may occur in any part of the multiplier.

EXAMPLES FOR PRACTICE.

1. Multiply 155 by 102? *Ans.* 15810.
2 Multiply 16520 by 205? *Ans.* 3386600.
3. Multiply 94325 by 5002? *Ans.* 471813650.
4. Multiply 70638 by 2005? *Ans.* 141629190.

QUESTIONS.—Art. 29. When ciphers occur in any part of the multiplier, what is the rule? In the first example, how do you proceed? And in the second example?

5. Bought 135 cwt. of steel at 109 dollars per cwt.; what sum will pay for it? *Ans.* 14715 dolls.

6. What sum will pay 2500 soldiers, each soldier to receive 1008 dollars? *Ans.* 2520000 dolls

ART. **30.** COMPOSITE NUMBERS.—(See Art. 3.)

To multiply by a composite number, use the following

RULE.

Multiply the multiplicand by one of the factors of the multiplier, and this product again by another factor, and so proceed with all the factors of the multiplier, and the last product will be the answer.

Ex.—Bought 35 acres of land at 24 dollars per acre; what sum will pay for it? *Ans.* 840 dolls.

OPERATION.

35 $4 \times 6 = 24$
4
———
140
6
———
840 dollars.

The factors of 24 are 4 and 6. Now if we multiply the 35 acres by 4, one of the factors, the product is 140; again if we multiply this product by 6, the other factor, we find the product to be 840 dollars, the price of the 35 acres.

EXAMPLES FOR PRACTICE.

1. Multiply 96 by $15 = 3 \times 5$? *Ans.* 1440
2. Multiply 85 by 25? *Ans.* 2125
3. Multiply 125 by 81? *Ans.* 10125.
4. Multiply 542 by 27? *Ans.* 14634.
5. Multiply 785 by 72? *Ans.* 56520
6. Multiply 1283 by 144? *Ans.* 184752
7. Multiply 845 by 108? *Ans.* 91260
8. Multiply 1516 by 42? *Ans.*

QUESTIONS.—Art. 30. What is the rule for multiplying by composite numbers? Explain the example?

SECTION V.

DIVISION.

ART. **31.** DIVISION teaches the method of finding how many times one number is contained in another.

In division there are three principal terms, namely: the *Dividend*, the *Divisor*, and the *Quotient* or *answer*.

The *dividend* is the number to be divided.

The *divisor* is the number by which we divide.

The *quotient* is the number of times the divisor is contained in the dividend.

When the dividend does not contain the divisor, an exact number of times, the excess is called the *remainder*.

ART. **32.** The sign of division is a short horizontal line, with a dot above it and another below: thus, $\div$. It shows that the number *before* it is to be divided by the number after it: as, $6 \div 3 = 2$.

Division is also indicated by writing the dividend above the divisor, with a line between them: thus, $\frac{6}{3} = 2$, read 6 divided by 3 is equal to 2.

MENTAL EXERCISE.

ART. **33.** Ex. 1.—A man gave 9 apples to be divided between 3 boys, how many apples did each boy receive?

Solution.—As many times as 3 is contained in 9, so many apples did each receive. Now 3 is contained in 9, 3 times; therefore, each boy received 3 apples.

2. If you divide 4 marbles between 2 boys, how many will each receive?

3. How many times 2 in 4? In 6? In 8? In 10?

4. If 1 peach cost 2 cents, how many can I buy for 10 cents? For 14? For 16? For 20?

5. How many times 3 in 6? In 9? In 12?

6. How many times 3 in 4? and how many off?

QUESTIONS.—Art. 31. What does division teach? What are the principal terms? What is the Dividend? The Divisor? The Quotient? The Remained?—Art. 32. What is the sign of division, and what does it show? How may division be also indicated?

7. How many times 3 in 7? In 10? In 13? In 16? and how many off?

8. If you can buy one slate for 4 cents, how many can you buy for 16 cents?

9. A man bought 7 sheep for 49 dollars, what did he give a piece?

10. How many oranges can you buy for 36 cents, at 6 cents a piece?

11. How many times 6 in 36? In 48? In 54?

12. Gave 56 cents for 8 pounds of raisins; what will 1 pound cost?

13. A lady divided 20 oranges between her 5 children, how many did each receive?

14. If 4 pies cost 12 cents, what will 1 cost?

15. How many times 7 in 14? In 21? In 28? In 35? In 49? In 77? In 84?

16. How many times 8 in 16? In 24? In 32? In 40? In 48? In 64? In 96?

17. How many times 9 in 18? In 27? In 36? In 81? In 90?

18. How many times 12 in 36? In 60? In 72? In 84? In 144?

SHORT DIVISION.

CASE I.

ART. **34.** If the divisor be 12, or any figure less than 12, the operation is called *short division.*

Ex. 1. Let it be required to divide 842 by 2.

Divisor 2)8 4 2 *Dividend.*
4 2 1 *Quotient.*

The 2 is contained in 8, 4 times, which is written directly under the 8. Then 2 is contained in 4, twice, and in 2 once, which are written respectively under the 4 and 2.

Ex. 2. Let it be required to divide 529 by 4.

Divisor 4)5 2 9 *Dividend.*
1 3 2+1 *Quot.*

In this example, 4 the divisor, is contained in 5, the first left hand figure of the dividend, once and 1 off;

QUESTIONS.—Art. 34 What is short division? Explain the examples write the quotient figure 1, directly under the 5, and then imagine the 1 that is off, to be placed before the 2 of the dividend, thus forming the number 12. We then divide 4, the divisor, into 12, and it is contained 3 times, which is written directly under the 2 of the dividend. Lastly, 4 is contained in 9 twice, and 1 over; this 1 is called the *remainder*, and annexed to the quotient by the sign of addition.

ART. **35.** From the foregoing illustration, we deduce the following rule for *short division.*

RULE.

I. *Write down the divisor on the left of the dividend, draw a curve line between them, and a straight line under the dividend.*

II. *Then find how many times the divisor is contained in the first, or the two first figures of the dividend, and place the result in the quotient directly under that figure or figures.*

III. *If there be no remainder in the first operation, divide the next figure in the dividend by the divisor.*

IV. *But if there be a remainder after dividing any figure, place the remainder directly before the next figure of the dividend, and then try how many times these two figures together will contain the divisor, place the result as before, and so proceed until all the figures of the dividend are divided.*

PROOF.—Multiply the divisor and quotient together, and to the product add the remainder if any, and the sum thus obtained will be equal to the dividend, if the work be correct

EXAMPLES FOR PRACTICE.

	1.		2.	
Divisor	2)426	*Dividend.*	4)5294	
	213	*Quotient.*	1323+2	*Remainder*
	PROOF.		PROOF.	
	213	*Quotient.*	1323+2	*Quotient.*
	2	*Divisor.*	4	*Divisor.*
	426	*Dividend.*	5294	*Dividend.*

QUESTIONS.—Art. 35. What is the rule for short division? How do you prove the work?

3. 3)963 4\. 4)856 5\. 5)6570 6\. 6)72852

7. 7)856 8\. 8)9056 9\. 9)1029 10\. 11)1246

	Quotients.	Rem.
11. Divide 86924 by 2.	43462	—
12. Divide 95167 by 3.	31722	1
13. Divide 12678 by 4.	3169	2
14. Divide 75613 by 5.	15122	3
15. Divide 14789 by 6.	2464	5
16. Divide 95328 by 7.	13618	2
17. Divide 18903 by 9.	2100	3
18. Divide 95100 by 10.	9510	—
19. Divide 15785 by 11.	1435	—
20. Divide 48672 by 12.	4056	—

APPLICATION.

1. If 6 pounds of sugar cost 36 cents, what will one pound cost? *Ans.* 6 cents.

2. John divided 25 marbles between 5 companions, how many did each receive? *Ans.* 5.

3. Bought 7 yards of muslin for 84 cents, how much did it cost per yard? *Ans.* 12 cents.

4. Bought 12 oranges for 60 cents, what is the price of one orange? *Ans.* 5 cents.

5. If 15820 dollars be divided between 7 persons; how much will each receive? *Ans.* 2260 dollars.

6. A laborer received 672 dollars for 12 month's service; what did he receive per month? *Ans.* 56 dollars.

7. There are 4 farthings in one penny, how many pence in 9860 farthings? *Ans.* 2465 pence.

8. A man gave 96 cents for 8 knives; what was the price of each? *Ans.* 12 cents.

9. Divide 1260 dollars between 9 persons, and tell what each one will receive? *Ans.* 140 dollars.

Note.—The following questions are solved by subtraction, addition and division.

10 Francis had 100 marbles, he gave away 25, lost 15,

and then divided the remainder between his five companions; how many had each? *Ans.* 12.

11. Bought 555 pounds of sugar, sold at one time 35 pounds, at another 91, at another 75 pounds; and then divided the remainder into 6 equal parcels; how many pounds in each parcel? *Ans.* 59 pounds.

12. A man had 5432 dollars, of which he gave 1520 dollars for charitable purposes, 1500 for a house, and divided the remainder between 3 nephews; how much did each receive? *Ans.* 804 dollars.

CASE II.

LONG DIVISION.

ART. **36.** When the divisor is any number over 12, the operation is called *Long Division.*

Ex. Let it be required to divide 322 by 14.

```
                Dividend.
 Divisor  1 4 ) 3 2 2 ( 2 3
                2 8
                ---
                  4 2
                  4 2
                  ---
                  0 0
          Proof.
 Quotient  2 3
 Divisor   1 4
          ----
           9 2
         2 3
         ----
         3 2 2 Dividend.
```

Having arranged the divisor and dividend, as shown in the example, we try how many times 14 is contained in 32, the two left hand figures of the dividend, and finding that it is contained twice, we write the 2 in the quotient, on the right hand of the dividend. We then multiply the divisor 14, by it, and write the product 28 under 32, and subtract one from the other. We find the remainder to be 4. Bring down the next figure of the dividend and place it to the right of the remainder; it then becomes 42. Again divide this number by 14, the divisor, and place the result in the quotient; multiply the divisor by it, and subtract the product from 42, we find the remainder to be nothing.

QUESTIONS.—Art. 36. What is long division? Explain the examples?

Finally, having multiplied the quotient 23 by 14, the divisor, the product is found to be 322, the dividend, which proves the operation to be correct.

Art. **37.** From the foregoing examples, we deduce the following rule for long division :

RULE.

I. *Write the divisor on the left of the dividend, and draw a curve line between them, and another curve line on the right of the dividend.*

II. *Then take as many figures on the left of the dividend, as will contain the divisor; try how many times this partial dividend will contain the divisor, and place the result on the right of the dividend; this will be the first figure of the quotient. Then multiply the divisor by this figure and write the product under the partial dividend.*

III. *Next subtract this product from the partial dividend, and to the remainder, bring down the next figure of the dividend; and try how many times this number will contain the divisor, place the result of this trial in the quotient, and proceed as before until all the figures in the dividend are brought down.*

Proof.—The best method of proof is that given under the rule of the former Case. Sometimes, however, the following method may be used: *Subtract the remainder, if any, from the dividend, and divide the difference by the quotient.* If the work be correct, the result will be the original divisor.

Note 1.—The remainder must always be *less* than the divisor.

Note 2.—If it happens, after a figure is brought down, that the number will not contain the divisor, a cipher must be placed in the quotient, and the next figure of the dividend, must be brought down, and so continue until the number becomes large enough to contain the divisor.

Questions.—Art. 37. What is the rule for long division? What method of proof is sometimes used? What must the remainder be? If the figure brought down be too small to contain the divisor, what must be done?

EXAMPLES FOR PRACTICE.

1. *Dividend.*	PROOF BY MULTIPLICATION
Divisor 21)3051(145 *Quotient.*	145 *Quotient.*
21	21 *Divisor*
95	145
84	290
111	3045
105	6 *Remainder*
6 *Remainder.*	3051 *Dividend.*

2.	PROOF BY DIVISION.
Dividend.	*Dividend.*
Divisor 14)3276(234 *Quotient.*	234)3276(14 *Divisor.*
28	234
47	936
42	936
56	
56	

	Quotients.	Rem
3. Divide 1778 by 14.	127	—
4. Divide 1845 by 15.	123	—
5. Divide 2169 by 18.	120	9
6. Divide 2500 by 25.	100	—
7. Divide 3639 by 27.	134	21
8. Divide 7540 by 59.	127	47
9. Divide 35645 by 215.	165	170
10. Divide 58650 by 425.	138	—
11. Divide 98629 by 687.	143	388
12. Divide 75863 by 3421.	22	601

ART. **38.** The operation in long division may be abbreviated, when the divisor is 10, 100, 1000, &c. by the following

RULE.—*Cut off as many figures from the right of the dividend, as there are ciphers in the divisor. The figures cut off will be the remainder, and the balance the quotient.*

QUESTIONS.—Art. 38. What is the rule for dividing by 10, 100, &c ? What will the figures cut off be?

Ex. Let it be required to divide 652 by 10 and by 100.

Dividend
1|0)65|2

Quotient 65 + 2 *Remainder*

Dividend.
1|00)6|52

Quotient 6 + 52 *Remainder.*

It will be seen by referring to Art. 27, that any number is multiplied by annexing a cipher to the right, which removes the figures one place to the left, and thus *increases* their value *ten times*. So, on the contrary, if a figure be removed from the right of a number, the value of that number is diminished *ten times*, or divided by 10. For the same reason, if we remove or cut off *two*, *three*, or *four figures* from the right of a number, the number is diminished, or divided by 100, 1,000, &c.

Examples for Practice.

	Quotient.	Rem.
1. Divide 540 by 10.	54	
2. Divide 7843 by 10.	784	3
3. Divide 9465 by 100.	94	65
4. Divide 7920 by 1000.	7	920
5. Divide 125865 by 10000.	12	5865

Art. **39.** When the divisor consists of figures greater than 1, with ciphers to the right, the operation may be shortened by the following

Rule.—*Cut off the ciphers from the divisor, and the same number of figures from the right hand of the dividend. Then divide the remaining figures of the dividend, by the remaining figures of the divisor, and the quotient will be the correct answer.*

Note.—After cutting off the ciphers of the divisor, if the remaining number be a single figure, or a number not exceeding 12. the operation may be performed by *short* division. But if the remaining number exceed 12, the operation will have to be performed by *long division.*

Questions.—Art. 38. What will be seen by referring to Art. 27 If a figure be cut off from the right of the *dividend*, what is the effect·—Art. 39. What is the *rule*, when the divisor consists of figures greater than 1, with ciphers to the right? After cutting off the ciphers, how may the operation be performed when the remainder does not exceed 12 And if greater than 12? Explain the operation in the given example.

EXAMPLES FOR PRACTICE.

Ex. Let it be required to divide 452 by 20.

2|0)45|2

———

Quot. 22 + 12 *Remainder.*

In this example we cut off the cipher from the divisor, and the 2 from the right of the dividend, and perform the operation by short division. The 2 of the divisor, it will be observed, is contained in the 5 of the dividend, twice, and 1 off; this 1 must be written to the left of the 2, the figure cut from the dividend; this makes it 12, the true remainder.

	Quotient.	Rem.
1. Divide 846 by 40.	21	6
2. Divide 1565 by 50.	31	15
3. Divide 1934 by 80.	24	14
4. Divide 87600 by 1200.	73	—
5. Divide 79872 by 240.	332	192
5. Divide 125462 by 2500.	50	462

APPLICATION.

1. If one yard of muslin cost 15 cents, how many yards can I buy for 465 cents? *Ans.* 31 yards.

2. At 16 cents a pound, how many pounds of coffee can I buy for 688 cents? *Ans.* 43 pounds.

3. If a man receive 150 dollars for 25 days' work, how much did he receive per day? *Ans.* 6 dollars.

4. Being desirous to plant 2,072 apple trees in 14 rows, how many in each row? *Ans.* 148 trees.

5. A vessel sailed 3,264 miles in 136 days, how many miles was that per day? *Ans.* 24 miles.

6. Paid 400 dollars to 25 men, how much did each man receive? *Ans.* 16 dollars.

7. The President of the United States receives a salary of 25,000 dollars annually; what does he receive per day? *Ans.* 68 + dollars.

8. If 18 acres cost 270 dollars, what will one acre cost? *Ans.* 15 dollars.

9. If 98 pounds of sugar cost 1,372 cents, what will one pound cost? *Ans.* 14 cents.

10. In 342 windows there are 8,208 panes of glass; at that rate, how many in each window? *Ans.* 24 panes

11. If 752 sheep cost 4,512 dollars, what will one cost? *Ans.* 6 dollars.

12. If 1,528 pounds of butter cost 24,448 cents, what is the price of one pound? *Ans.* 16 cents.

13. If a man travel 40 miles a day, how long will it take him to travel 240 miles? *Ans.* 6 days.

14. There are 60 seconds in one minute, how many minutes in 128,400 seconds? *Ans.* 2,140 minutes.

15. There are 24 hours in one day, how many days in 75,840 hours? *Ans.* 3,160 days

16. If 352 dollars be divided between 16 men, what will each receive?

17. There are 144 square inches in one square foot, how many square feet in 485,621 square inches?

SECTION VI.

MISCELLANEOUS EXAMPLES

IN ADDITION, SUBTRACTION, MULTIPLICATION AND DIVISION.

1. Bought a lot of ground for 875 dollars, and sold it for 986 dollars, how much did I gain? *Ans.* 111 dollars.

2. Bought a certain quantity of oats for 240 dollars, and sold it for 294 dollars; how much did I gain? *Ans.* 54 dolls.

3. What will a farm of 175 acres cost, at 45 dollars per acre? *Ans.* 7,875 dollars.

4. A. bought a quantity of corn for 345 dollars, but finding it damaged, he is willing to sell it for 318 dollars; how much did he lose? *Ans.* 27 dollars.

5. A certain number of men were concerned in the payment of 1,560 dollars, and each man paid 5 dollars; what was the number of men? *Ans.* 312 men.

6. In a certain city 3,925 dollars were distributed to 785 poor; how much did each receive? *Ans.* 5 dollars.

7. The expense of an army of 19,000 men for a certain time was 266,000 dollars, what was the expense of each? *Ans.* 14 dollars

8. How many square feet of boards will cover a floor 45 feet long and 20 wide? *Ans.* 900 feet.

9. In one square yard there are 9 square feet. how many yards of carpeting will it take to cover a room 32 feet long and 24 wide? *Ans.* 85 + yards.

10. Bought 18 yards of muslin at 14 cents per yard; 9 yards of calico at 15 cents per yard: 3 yards of linen at 75 cents per yard; what is the amount of my bill? *Ans.* 612 cents.

11. A man travelled from New York to Boston in 9 days, at the rate of 25 miles per day; what is the distance between those two cities? *Ans.* 225 miles.

12. How much sugar at 15 dollars per cwt., can I buy for 405 dollars? *Ans.* 27 cwt.

13. The annual revenue of a certain house is 8395 dollars; how much is that per day, there being 365 days in a year? *Ans.* 23 dollars.

14. If in one dollar there are 100 cents, how many dollars in 95000 cents? *Ans.* 950 dollars.

15. In one acre there are 160 square rods: how many acres in 1086240 square rods? *Ans.* 6789 acres.

16. A man dying left 25000 dollars to be divided between 6 children; a daughter was to have 5000. and the balance was to be divided equally between the sons, what was the share of each son? *Ans.* 4000 dollars.

17. A merchant bought five pieces of cloth, the first contained 37 yards, the second 29, the third 35, the fourth 27, and the fifth 25, and having sold 85 yards of his cloth, how many yards had he left? *Ans.* 68 yards.

18. The Bible contains 31173 verses; how many must be read per day to read it through in a year? *Ans.* 85 + verses.

19. There are 60 minutes in an hour; how many minutes in 24 hours, or in one day? *Ans.* 1440 minutes.

20. A certain family uses 5 loaves of bread a day, at a cost of 5 cents a loaf: how many loaves are consumed in a year, and what sum will pay for them?

SECTION VII.

TABLES OF MONEY, WEIGHTS AND MEASURES

Art. **40.** United States Money is the legal currency of the United States.

TABLE.

10 Mills	make	1 Cent,	marked	c.
10 Cents	“	1 Dime,	“	d.
10 Dimes	“	1 Dollar,	“	$.
10 Dollars	“	1 Eagle,	“	E.

Note.—It will be seen by this table that there are five different denominations used in the currency of the United States, viz: Mills, Cents, Dimes, Dollars, and Eagles; and that they increase in value in *tenfold* proportion. Accounts, however, are kept only in *dollars* and *cents.*

It is frequently called *Federal Money*, because on the adoption of the Federal Constitution, it was made the currency of the Federal Union

English Money.

4 Farthings	make	1 Penny,	marked	d.
12 Pence	“	1 Shilling,	“	s.
20 Shillings	“	1 Pound,	“	£.
21 Shillings	“	1 Guinea,	“	G.

Avoirdupois Weight.

16 Drams	make	1 Ounce,	marked	oz.
16 Ounces	“	1 Pound,	“	lb.
[illegible] Pounds	“	1 Quarter,	“	qr.
4 Quarters	“	1 Hundred Weight,	“	cwt.
20 Hundred Weight	“	1 Ton,	“	T.

Note.—By this weight are weighed all kinds of goods, groceries, &c.; and all kinds of metals, except gold and silver. A ton is reckoned at the Custom-houses of the United States at 2240 lbs.

Troy Weight.

24 Grains	make	1 Pennyweight,	marked	dwt.
20 Pennyweights	“	1 Ounce,	“	oz.
12 Ounces	“	1 Pound,	“	lb.

Note.—The original of all weights used in England, was a grain of wheat gathered out of the middle of the ear: 32 of these, well dried, made one pennyweight; 20 pennyweights, one ounce; and 12 ounces one pound. At present, the pennyweight is divided into 24 equal parts, called *grains*.

APOTHECARIES' WEIGHT.

20 Grains	make	1 Scruple,	marked	sc. or ℈
3 Scruples	“	1 Dram,	“	dr. or ʒ
8 Drams	“	1 Ounce,	“	oz. or ℥
12 Ounces	“	1 Pound,	“	lb. or ℔

Note.—Apothecaries mix their medicines by this weight, but they buy and sell by avoirdupois weight

LONG MEASURE.

3 Barley-corns	make	1 Inch,	marked	in.
12 Inches	“	1 Foot,	“	ft.
3 Feet	“	1 Yard,	“	yd.
6 Feet	“	1 Fathom,	“	fth.
5½ Yards	“	1 Rod, or Pole,	“	rd.
40 Rods	“	1 Furlong,	“	fur.
8 Furlongs	“	1 Mile,	“	m.
3 Miles	“	1 League,	“	lea.
60 Geographical, or 69½ Statute Miles	“	1 Degree,	“	deg
360 Degrees	“	1 Circle of the Earth.		

Note.—Long Measure is used in measuring distances.

CLOTH MEASURE.

2¼ Inches	make	1 Nail,	marked	na.
4 Nails	“	1 Quarter of a yard,	“	qr
4 Quarters	“	1 Yard,	“	yd.
3 Quarters	“	1 Ell Flemish,	“	E. F
5 Quarters	“	1 Ell English,	“	E. E

Note.—Cloth Measure is used for measuring cloth, lace, ribbons, and all other articles sold by the yard. The Ell French is no longer in use

LAND, OR SQUARE MEASURE.

144 Square inches	make	1 Square foot,	marked	ft.
9 Square feet	"	1 Square yard,	"	yd.
30¼ Square yards	"	1 Square rod or pole,	"	p.
272¼ Square feet	"	1 Square rod or pole,	"	p.
40 Square rods or poles	"	1 Rood,	"	R.
4 Roods, or 4840 square yards	"	1 Acre,	"	A.
640 Acres	"	1 Square mile,	"	S. M

Note.—Square Measure is used in measuring surfaces of all kinds such as land, floors, plastering, &c.

SOLID, OR CUBIC MEASURE.

1728 Cubic inches	make	1 Cubic foot.
27 Cubic feet	"	1 Cubic yard
40 Cubic feet of round, or 50 Cubic feet of square timber	"	1 Ton.
128 Cubic feet, that is, 8 in length, 4 in breadth, and 4 in height	"	1 Cord.

Note.—Cubic Measure is used for measuring such bodies as have length, breadth and thickness; as stone, timber, &c.

WINE MEASURE.

4 Gills	make	1 Pint,	marked	pt.
2 Pints	"	1 Quart,	"	qt.
4 Quarts	"	1 Gallon,	"	gal.
31½ Gallons	"	1 Barrel,	"	bar.
42 Gallons	"	1 Tierce,	"	tier.
63 Gallons	"	1 Hogshead,	"	hhd.
2 Tierces	"	1 Puncheon,	"	pun
2 Hogsheads	"	1 Pipe or butt,	"	pi.
2 Pipes or 4 Hhds.	"	1 Tun,	"	tun.

Note.—Wine Measure is used for measuring all kinds of liquids, except *milk*, *ale* and *beer*. The standard wine gallon, used in the United States, contains 231 cubic inches. The Imperial gallon now used in Great Britain, contains 277.274 cubic inches

ALE AND BEER MEASURE.

2 Pints	make	1 Quart,	marked	qt.
4 Quarts	"	1 Gallon,	"	gal.
31½ Gallons	"	1 Barrel,	"	bar.
54 Gallons	"	1 Hogshead,	"	hhd
2 Hogsheads	"	1 Butt,	"	butt.
2 Butts	"	1 Tun,	"	tun.

NOTE.—By this Measure milk, ale, beer and cider are measured. The ale gallon contains 282 cubic inches.

DRY MEASURE.

2 Pints	make	1 Quart,	marked	qt.
4 Quarts	"	1 Gallon,	"	gal.
2 Gallons or 8 Quarts	"	1 Peck,	"	pk.
4 Pecks	"	1 Bushel,	"	bu.

NOTE.—Grain, fruit, salt, coal, &c., are measured by this Measure.

TIME.

60 Seconds	make	1 Minute,	marked	m.
60 Minutes	"	1 Hour,	"	h.
24 Hours	"	1 Day,	"	d.
7 Days	"	1 Week,	"	w.
4 Weeks	"	1 Month,	"	mo.
12 Calendar, or 13 Lunar Months	"	1 Year,	"	y.
365 Days and 6 hours	"	1 Year,	"	y.

NOTE.—As the common year contains 365 days and 6 hours, every fourth year, called *leap year*, will contain 366 days. When a leap year occurs, February will have 29 days in it. The days in each month are stated in the following lines:

"Thirty days hath September,
April, June, and November,
All the rest have thirty-one,
Except the second month alone,
Which hath indeed, but twenty-eight,
Till *Leap Year* gives it twenty-nine."

CIRCULAR MEASURE.

60 Seconds (″)	make	1 Minute,	marked	′
60 Minutes	"	1 Degree,	"	°
30 Degrees	"	1 Sign,	"	S.
12 Signs, or 360 Degrees	"	The Circle of the Zodiac,		C.

NOTE.—This Measure is used in reckoning latitude and longitude, in computing the revolutions of the planets around the sun, and in the division of circles.

ART. 41.—MISCELLANEOUS TABLES.

A Gallon of train oil	weighs	7½	Pounds
A Stone of butcher's meat	"	8	"
A Gallon of molasses	"	11	"
A Stone of iron	"	14	"
A Firkin of butter	"	56	"
A Firkin of soap	"	94	"
A Quintal of fish	"	100	"
A Sack	"	364	"
A Puncheon of foreign prunes	"	1120	"
A Fother of lead	"	19½	Cwt.
A Barrel of flour	"	196	Pounds
A Barrel of beef or pork	"	200	"
A Barrel of shad (generally)	"	200	"
A Barrel of soap	"	256	"
A Last of gunpowder	"	4368	"
A Cubit	measures	18	Inches.
A Sacred Cubit	"	22	In. nearly
A Hand	"	4	Inches.
A Fathom	"	6	Feet.
An English mile	"	1760	Yards
An Italian mile	"	1467	"
An Irish and Scotch mile	"	2200	"
A Polish mile	"	4400	"
A Spanish mile	"	5028	"
A German mile	"	5866	"
A Quire of paper	contains	24	Sheets.
A Ream of paper	"	20	Quires.
A Bundle of paper	"	2	Reams.

12 Single things	make	1	Dozen.
12 Dozen	"	1	Gross.
12 Gross, or 144 dozen	"	1	Great Gross
20 Single things	"	1	Score.
5 Score	"	1	Hundred

SECTION VIII.

REDUCTION.

ART. **42.** REDUCTION is the changing or reducing of numbers, either simple or compound, from one denomination to another without altering their values.

Reduction is of two kinds, viz. *Descending* and *Ascending*.

Reduction Descending is the changing of numbers from a higher to a lower denomination; as the changing of pounds to shillings, &c. This operation is performed by *multiplication.*

Reduction Ascending is the changing of numbers from a lower to a higher denomination; as the changing of pence to shillings, and shillings to pounds, &c. The operation is performed by *division.*

ART. **43.** A SIMPLE number is a number which expresses things of the *same* kind or denomination; as, 10 yards, 5 apples.

A COMPOUND number is a number which expresses things of different kinds, or denominations, taken collectively; as, 10 yards, 3qrs., 1na.

CASE I.

ART. **44.** *To reduce numbers from a higher to a lower denomination.*

QUESTIONS.—Art. 42. What is reduction? How many kinds of reduction? What is reduction *descending*? Reduction ascending?—Art. 43. What is a simple number? A compound number?—Art. 44. Explain the operation in the example?

Ex. Let it be required to reduce 6£. 8s. 4d. to pence.

6£. 8s. 4d.
20
——
128 shillings.
12
——
1540 pence.

We multiply the 6 pounds by 20, because there are 20 shillings in one pound, and the product is 120 shillings; to this we add the 8 shillings. We then multiply the shillings by 12, because there are 12 pence in a shilling, and again add to this product the 4 pence, when the whole is reduced to pence.

Art. **45.** From the preceding illustration, we deduce the following general rule for *Reduction Descending.*

RULE.

Multiply the highest denomination, by so many units, as will make one of the next less denomination. If there be any figures of the same kind as the next denomination, add them to the product, and so proceed until they are all reduced to the denomination required.

UNITED STATES MONEY.

Art. **46**. The following rules will be found convenient in reducing dollars to cents, dollars to mills, and cents to mills.

RULE

I. *To reduce dollars to cents: Annex* TWO *ciphers.*
II. *To reduce dollars to mills: Annex* THREE *ciphers*
III. *To reduce cents to mills: Annex* ONE *cipher.*

Note.—For the reason of this rule see Art. 27.

1. Reduce $25 to cents? *Ans.* 2,500 cents.
2. Reduce $155 cents? *Ans.* 15,500 cents.
3. Reduce $85 to mills? *Ans.* 85,000 mills.
4. Reduce $21 to mills? *Ans.* 21,000 mills.
5. Reduce $5 to mills? *Ans.* 5,000 mills.

Questions.—Art. 45. What is the general rule for reduction descending? What are the rules for the reduction of U. States money?

6. Reduce 25 cents to mills? *Ans.* 250 mills
7. Reduce $15.25 to mills? *Ans.* 15,250 mills.
8. Reduce $985 to cents? *Ans.* 98,500 cents.

Examples for Practice, embracing all the tables.

ENGLISH MONEY.

1. Reduce 5£. to shillings? *Ans.* 100 shillings
2. In 9£., how many shillings and pence?
Ans. 180 shillings and 2,160 pence
3. In 4£. 6s. 8d., how many pence? *Ans.* 1,040 pence
4. In 25£. 7s. 4d., how many farthings?
Ans. 24,352 farthings
5. In 125£. 10s., how many farthings? *Ans.* 120,480

AVOIRDUPOIS WEIGHT.

1. Reduce 10 pounds to ounces? *Ans.* 160 ounces.
2. In 7lbs. how many drams? *Ans.* 1,792 drams
3. In 8cwt., how many quarters and pounds?
Ans. 32 quarters and 896 pounds
4. Bring 6 tons to cwt., quarters and pounds?
Ans. 120cwt. 480qrs. and 13,440lbs
5. In 15 tons, how many cwts. quarters, pounds, ounces, drams? *Ans.* 300cwt. 1,200qrs., 33,600lbs., 537,600oz.,
[8,601,600dr
6. In 1 ton, how many drams?

TROY WEIGHT.

1. In 10dwt. how many grains? *Ans.* 240.
2. In 15 ounces, how many pennyweights? *Ans.* 300.
3. In 5lbs. how many ounces? *Ans.* 60.
4. In 8lbs. how many ounces, dwt. and grains?
Ans. 96oz. 1,920dwt. 46,080grs

APOTHECARIES' WEIGHT.

1. In 12 scruples, how many grains? *Ans.* 240.
2. In 15 drams, how many scruples? *Ans.* 45.
3. In 20 pounds, how many ounces? *Ans.* 240
4. Reduce 10lbs. to ounces, drams and scruples?
Ans. 120oz., 960drs., 2,880sc

LONG MEASURE.

1. Reduce 5 inches to barley-corns? *Ans.* 15
2. Bring 15 feet to inches? *Ans.* 180
3. In 20 fathoms, how many feet? *Ans.* 120
4. In 25 yards, how many feet? *Ans* 75
5. In 15 furlongs, how many rods? *Ans.* 600
6. In 35 miles, how many furlongs? *Ans.* 280
7. In 40 leagues, how many miles? *Ans.* 120
8. In 75 degrees, how many geographical miles; and how many statute miles? *Ans.* 4,500 geo., 5,212½ stat
9. How many miles in 360 degrees?

CLOTH MEASURE.

1. Reduce 12 nails to inches? *Ans.* 27 inches.
2. In 15 quarters, how many nails? *Ans.* 60 nails.
3. In 18 yards, how many quarters? *Ans.* 72 quarters.
4. How many quarters in 10 Ells English? *Ans.* 50qr.
5. How many quarters and nails in 20 yards? *Ans.* 80 qr. and 320 nails.
6 In 25yds., 2qrs., 1 nail, how many nails? *Ans.* 102qr. and 409 nails

LAND OR SQUARE MEASURE.

1. Reduce 5 square feet to inches? *Ans.* 720.
2. In 10 yards, how many square feet? *Ans.* 90.
3. How many yards in 75 square poles? *Ans.* 2,268¾.
4. In 15 roods, how many poles? *Ans.* 600.
5. In 27A., 1R., 32P., how many perches? *Ans.* 4,392
6. How many acres, roods and perches in 5 miles?
7. In 1 mile, how many square yards and feet?

CUBIC MEASURE.

1. How many cubic inches in 6 cubic feet? *Ans.* 10,368.
2. In 9 cubic yards, how many cubic feet? *Ans.* 243.
3. How many cubic feet in 3 ton of round timber; how many of square timber? *Ans.* 120 round and 150 square.
4. In 5 cords of wood, how many cubic feet? *Ans.* 640

WINE AND ALE MEASURES.

1. Reduce 2 gallons, 2 quarts and 1 pint, wine measure, to gills? *Ans.* 84 gills

2. In 65 gallons, how many quarts and pints? *Ans.* 260qt. 520pt

3. How many quarts and pints in one barrel? *Ans.* 126qt. 252pt

4 How many quarts in a hogshead, ale measure? *Ans.* 216qt.

5 How many quarts and pints in a hogshead, wine measure? *Ans.* 252qt. 504pt.

5. How many gallons, quarts and pints in 6 pipes? *Ans.* 756gal. 3024qt. 6048pt.

7. In one butt, ale measure, how many pints? *Ans.* 864pt.

8. Reduce 3 tuns, 2 hogsheads, 35 gallons, 3 quarts and 1 pint, wine measure, to pints? *Ans.* 7,343pt.

9. In 3 tuns, 2 hogsheads, 35 gallons, 3 quarts and 1 pint, ale measure, how many pints? *Ans.* 6,335pt.

10. A man bought ° barrels of cider, how many gallons?

DRY MEASURE.

1. Reduce 5 gallons, 2 quarts and 1 pint to pints? *Ans.* 45pt.

2. In 3 pecks, how many gallons and quarts? *Ans.* 6gal. 24qt

3. How many pecks and quarts in 10 bushels? *Ans* 40pk. 320qt

4. In three bags, each containing 3 bushels and 3 pecks, how many pecks? *Ans.* 45pk.

TIME.

1. Reduce 25 minutes to seconds? *Ans.* 1,500sec.

2. How many minutes and seconds in 3 hours? *Ans.* 180m. 10,800sec.

3. How many hours in 1 week? *Ans.* 168h.

4. In 15 weeks, how many days? *Ans.* 105d.

5. How many lunar months in 5 years? *Ans.* 65m.

6. In 1 year, how many hours, minutes and seconds?

7. How many days and hours in a man's life, who died at the age of 27 years? *Ans.*

CIRCULAR MEASURE.

1. In 12 degrees, how many minutes and seconds? *Ans.* 720m. 43,200sec.

2. How many degrees and minutes in 5 signs? *Ans.* 150deg. 9,000m

3. In 8 signs, how many degrees? *Ans.* 240

CASE II.

REDUCTION ASCENDING.

ART. **47.** *To reduce numbers from a lower to a higher denomination.*

Ex. 1. Let it be required to reduce 3268 nails to yards.

OPERATION.

4) 3268 nails.
4) 817 qr.
Ans. 204yds. 1qr.

We first divide by 4, because 4 nails make 1 quarter, and the result is 817 quarters. We again divide the quarters by 4, because 4 quarters make 1 yard; and the result is 204 yards and 1 quarter off.

Ex. 2. Let it be required to reduce 1652 farthings to pounds.

OPERATION.

4) 1652far.
12) 413d.
20) 34s. 5d.
1£. 14s. 5d.

In this example, we divide by 4, because 4 farthings make one penny; and the result is 413 pence. Again we divide the pence by 12, to reduce them to shillings, because 12 pence make one shilling, and we find the result to be 34 shillings and 5 pence off. Lastly, we divide the shillings by 20, to reduce them to pounds, because there are 20 shillings in one pound. Hence the true result is 1£ 14s. 5d.

QUESTIONS.—Art. 47. Explain examples first and second? What is the rule for reduction ascending?

From the foregoing examples we deduce the following

RULE.

Divide the given denomination by the number of units in one of the next higher denomination. The remainder, if any, will be the same as the given denomination, and the quotient will be of the next higher denomination.

MENTAL EXERCISES.

1. In 30 mills, how many cents? In 40 mills? In 50 mills? In 90 mills?

2. In 200 cents, how many dollars? In 300 cents? In 700 cents?

3. How many pence in 16 farthings? In 24 farthings? In 40 farthings?

4. How many shillings in 24 pence? In 60 pence? In 96 pence?

5. In 40 shillings, how many pounds? In 80 shillings?

6. How many quarters in 20 nails? In 24 nails? In 32 nails?

7. In 12 quarters, how many yards? In 16 quarters? In 18 quarters? and how many quarters over? In 20 quarters? In 25 quarters?

8. How many feet in 24 inches? In 36 inches? In 60 inches?

9. How many yards in 9 feet? In 15 feet? In 18 feet? In 21 feet?

10. In 8 pints, how many quarts? In 12 pints? In 16 pints?

11. In 12 quarts, how many gallons? In 16 quarts? In 20 quarts?

12. How many pecks in 16 quarts? In 54 quarts?

13. How many bushels in 12 pecks? In 16 pecks? In 20 pecks? In 24 pecks? In 32 pecks?

UNITED STATES MONEY

ART. **48.** The following rules will be found convenient in reducing *mills* to *cents* and *dollars*.

RULE.

I. *To reduce mills to cents, point off* ONE *figure on the right; the figures on the left of the point will be cents, the figure on the right mills.*

II. *To reduce cents to dollars, point off* TWO *figures on the right; the figures on the left will be dollars, those on the right cents.*

III. *To reduce mills to dollars, point off* THREE *figures on the right; the figures on the left of the point will be dollars, the first two on the right of the point will be cents and the third mills.*

NOTE.—For the reason and illustration of the above rule, see Art. 27.

EXAMPLES FOR PRACTICE,

1. Reduce 250 mills to cents? *Ans.* 25 cents.
2. How many dollars in 12500 cents? *Ans.* $125
3. How many dollars and cents in 75250 mills? *Ans.* $75.25 cts.
4. In 1000000 of mills, how many dollars? *Ans.* $1000.
5. Reduce 9999 mills, how many dollars, cents and mills? *Ans.* $9.99 cts. 9 m.

ENGLISH MONEY.

1. Reduce 1000 farthings to pence? *Ans.* 250d.
2. Reduce 340 pence to shillings? *Ans.* 28s. 4d
3. Reduce 150 shillings to pounds? *Ans.* 7£. 10s
4. Reduce 844 pence to pounds? *Ans.* 3£. 10s. 4d
5. How many pounds in 25626 farthings? *Ans.* 26£. 13s. 10½d.

AVOIRDUPOIS WEIGHT.

1. Reduce 160 ounces to pounds? *Ans.* 10lbs
2. Reduce 1792 drams to pounds? *Ans.* 7lbs.

QUESTIONS.—Art. 48. What is the rule for reducing mills to cents? The rule for reducing cents to dollars? The rule for reducing mills to dollars?

3. Reduce 896 pounds to quarters and cwt? *Ans.* 32qr. 8cwt.
4. Reduce 13440 pounds to cwt. and tons? *Ans.* 120cwt. 6T.
5. In 3225600 ounces, how many tons? *Ans.* 90T.

TROY WEIGHT.

1. Reduce 2688 grains to dwt.? *Ans.* 112dwt.
2. Reduce 12480 grains to ounces? *Ans.* 26oz.
3. Reduce 840 dwt. to pounds? *Ans.* 3½lbs.
4. How many pounds in 11520 grains? *Ans.* 2lbs.

APOTHECARIES' WEIGHT.

1. Reduce 500 grains to scruples? *Ans.* 25sc.
2. Reduce 6400 scruples to drams? *Ans.* 2,133⅓dr.
3. Reduce 640 drams to ounces? *Ans.* 80oz.
4. Reduce 984 ounces to pounds? *Ans.* 82lbs.
5. How many pounds in 9990 grains?

LONG MEASURE.

1. Reduce 9600 inches to feet? *Ans.* 800ft.
2 Reduce 819 feet to yards? *Ans.* 273yds.
3. In 120 rods, how many furlongs? *Ans.* 3fur.
4. In 856 furlongs, how many miles? *Ans.* 107m.
5. In 16 miles, how many leagues? *Ans.* 5lea. 1m.

CLOTH MEASURE.

1. Reduce 48 nails to quarters? *Ans.* 12 quarters.
2. Reduce 150 quarters to yards? *Ans.* 37.5 yards.
3. How many yards in 342 quarters? *Ans.* 85.5 yards.
4. In 560 quarters, how many ells English? *Ans.* 112.
5 How many ells Flemish in 8960 quarters? *Ans.* 2,986⅔ ells Flemish
6. In 1264 nails, how many quarters and yards? *Ans.* 316qr. 79 yards

LAND OR SQUARE MEASURE.

1. Reduce 14688 square inches to square feet? *Ans.* 102 square feet.

2. Reduce 1890 square feet to square yards?
Ans. 210 square yards

3. In 3240 poles, how many roods? *Ans.* 81 roods

4. How many acres in 2844 roods? *Ans.* 711 acres

5. How many acres in 58443 square yards?
Ans. 12 acres, 0 rood, 12 poles

6. In 15600 poles, how many roods and acres?
Ans. 390 roods, 97½ acres.

CUBIC MEASURE.

1. Reduce 2265408 cubic inches to cubic feet?
Ans. 1311 cubic feet.

2. How many cubic yards in 1311 cubic feet?
Ans. 48 yards, 15 feet.

3. How many tons in 9840 feet of round timber, and how many of square timber? *Ans.* 246, 196⅘.

4. How many cords in 75,000 feet? *Ans.* 585c. 120ft.

5. How many feet and cords in 1,000,000 cubic inches?
Ans. 578ft. 1216in., 4c. 66ft

WINE AND ALE MEASURE.

1. How many gallons, quarts and pints in 8400 gills?
Ans. 2100pts. 1050qts. 262½gal

2. Reduce 54,240 quarts to gallons and hogsheads?
Ans. 13560gal., 215hhds. 15gals.

3. In 9990 gallons, how many hogsheads and tuns?
Ans. 158$\frac{4}{7}$hhds., 39$\frac{9}{14}$ tuns

4. How many hogsheads, ale measure, in 10,200 quarts?
Ans. 47hhds. 12gals.

5. Reduce 4032 quarts to tuns? *Ans.* 4 tuns.

DRY MEASURE.

1. Reduce 520 pints to pecks? *Ans.* 32½ pecks.

2. Reduce 136 pecks to bushels? *Ans.* 34 bushels

3. Reduce 648 quarts to bushels? *Ans.* 20¼ bushels.

4. How many bushels in 1856 pints? *Ans.* 29 bushels.

TIME.

1. Reduce 840 seconds to minutes? *Ans.* 14 minutes.

2. Reduce 984 minutes to hours? *Ans.* 16h. 24m

3. Reduce 12,500 minutes to days? *Ans.* 8d. 16h. 2m.
4. Reduce 136 days to weeks? *Ans.* 19 weeks, 3 days.
5. In 17,520 hours, how many days and years?
Ans. 730 days, 2 years.

CIRCULAR MEASURE.

1. Reduce 800 seconds to minutes? *Ans.* 13⅓ minutes.
2. In 15,200 minutes, how many degrees? *Ans.* 253⅓deg.
3. How many signs in 180 degrees? *Ans.* 6 signs.
4. How many signs in 5400 minutes? *Ans.* 3 signs

MISCELLANEOUS EXERCISES IN REDUCTION.

1. In 325 dollars, how many cents and mills?
Ans. 325,000 mills.
2. How many yards in 64 quarters? *Ans.* 16 yards.
3. In 25£., 10 shillings, 4 pence, how many pence?
Ans. 6124 pence.
4. In 95 yards, 3 quarters, how many nails?
Ans. 1532 nails.
5. How many pounds in 8640 farthings? *Ans.* 9£.
6. In 28 tons, 10 hundred weight, 3 quarters, 18 pounds, how many pounds? *Ans.* 63942 pounds
7 How many square feet in 34,216 square inches?
Ans. 237+sq. feet.
8. How many quarts in a hogshead of wine? *Ans.* 252qts.
9. How many cubic feet in 15 tons of timber?
Ans. 600 cubic feet.
10. How many quarts in 5 hogsheads of beer?
Ans. 1080 quarts.
11. How many hours and minutes in 99 days?
Ans. 2376h. and 142,560m
12. How many quarts and pints in 7 bushels?
Ans. 224qts. 448pts.
13. In 3,779 inches how many rods?
Ans. 18 rods, 5 yards, 2 feet, 11 in
14. How many seconds in 8s. 14°, 18′, 17″?
15. What is the value of a lot of ground containing 40 square rods and 200 square feet, at $1.50 per square foot?
Ans. $16,635

16. Bought 5 cwt., 3 quarters, 15 pounds of sugar, at 5 cents per pound, how much will it come to? *Ans.* $32.95

17. Bought 15 bushels of apples at 15 cents per peck, what sum will pay for them? *Ans.* $9.00

18. In 12 casks of prunes of equal weight, containing 3,492 pounds, what is the weight of one cask?
Ans. 2cwt., 2qr., 11lb.

19. In 17lbs., how many ounces, drams and scruples?
Ans. 204oz., 1,632drs., 4,896sc.

20. In 20 parcels of drugs each weighing 24 drams, how many pounds? *Ans.* 5 pounds.

21. In 10 bales of cloth, each containing 10 pieces, and each piece 12 yards, how many yards? *Ans.* 1,200 yards.

22. Require the earth's circumference in yards?
Ans. 44,035,200 yards.

23. Bought 50 reams of paper at 14 cents per quire, how much did it cost? *Ans.* $140.

24. A man bought a cask of wine containing 165 gallons, and wishes to put it into quart bottles; how many will be required to hold it? *Ans.* 660.

25. How many times will a wheel turn round in going 110 miles; the wheel being 12 feet 6 inches in circumference?
Ans. 46,464 times.

26. How many pence and farthings in 5 pounds?

27. How many cubic inches in 15 cubic feet?

28. How many minutes in the month of May?

29. In 350 quarters, how many yards and ells English?

30. How many quarters, pounds and ounces in 9 cwt?

SECTION IX.

COMPOUND ADDITION.

ART. **49.** COMPOUND ADDITION is the addition of numbers of different denominations.

Ex. 1. Let it be required to add together 4yds., 3qr., 2na and 3yds., 2qr. 3na.

QUESTIONS.—Art. 49. What is compound addition? Explain the examples

OPERATION.

	yd.	qr.	na.
	4	3	2
	3	2	3
Ans.	8	2	1

We write the different denominations directly over each other, placing over each its proper sign. Then we commence with the nails, the lowest denomination, and add up the column; we find the sum to be 5 nails. The 5 nails must be divided by 4, because there are 4 nails in 1 quarter; the result is 1 quarter and 1 nail over; we write this 1 nail under the column of nails, and carry the 1 quarter to the column of quarters. Having added up the column of quarters, the sum is 6 qr. equal to 1 yard and 2 quarters off. We write the 2 quarters under the column of quarters and carry the 1 yard, to the column of yards; and we find the sum of the whole to be 8 yards, 2 quarters and 1 nail.

Ex. 2. Let it be required to add together $5, 25cts., 5m. and $8, 87cts., 5m.

OPERATION.

	$. cts. m.
	5.25,5
	8.87,5
Ans.	14.13,0

We place the dollars under dollars, cents under cents, &c., then commence on the right hand, and perform the operation as in the addition of simple numbers; because 10 mills make one cent, and 100 cents make one dollar; hence, in adding mills and cents, the simple operation of writing down the right hand figure and carrying the left hand figure or figures, is the same as dividing by 10.

ART. **50.** From the above operation we deduce the following

RULE.

I. *Write all the given numbers of the same denomination, under each other; as pounds under pounds, shillings under shillings, &c.*

II. *Then add together the numbers of the lowest denomination, and divide their sum by so many units as will make* ONE *of the next higher denomination; set the remainder under the column added, and carry the quotient to the next left hand column,*

QUESTION.—Art. 50. What is the rule for compound addition?

the sum of which divide by the appropriate number, as before, and thus proceed to the highest denomination, under which place its whole sum.

Proof.—The proof is the same as in simple addition.

UNITED STATES MONEY.

Art. 51. As the different denominations of United States money, increase from left to right, and decrease in the same ratio, they may be *added, subtracted, multiplied,* and divided by the rules that apply to simple numbers.

In this work dollars are separated from cents by a period, or dot, and cents from mills by a comma: as, $20.25,5.

It will be observed that cents occupy two places of figures; the place of the *units,* and that of the *tens;* therefore, if the number of cents be less than 10, the place of the tens must be supplied by a cipher: as, 07, 03 cts., &c.

Examples for Practice.

1. 2	2. 3	3. 4	4. 5
$. cts. m.	$. cts. m.	$. cts. m.	$. cts. m.
15.25,5	95.50,8	15.20,3	99.03,7
64.12,5	63.75,2	18.78,4	71.01,3
50.12,2	87.25,0	45.17,5	85.02,2
129.50,2	246.51,0	79.16,2	255.07,2

5. 6	6. 7	7. 8	8. 9
$. cts. m.	$. cts. m.	$. cts. m.	$. cts. m
159.50,2	246.51,0	79.18,5	255.07,2
241.25,3	122.87,5	18.12,5	185.04,8
442.18,4	343.62,5	87.12,5	921.00,9
582.16,7	421.58,0	12.13,2	135.10,1
420.12,5	325.11,1	14.15,8	416.03,5

Questions.—Art. 51. What is said of the different denominations of U. States money? How may they be added, &c.? In this work how are dollars separated from cents, cents from mills? What places do cents occupy? If their number be less than 10, what must be done?

Jn, C. Oorman

APPLICATION.

1 **1.** Paid $4.50 for a hat, $9.75 for a coat, $3.50 for a vest, what was the amount of my bill? *Ans.* $17.75.

2 **2.** Bought a barrel of flour for $5.50, one cwt. of sugar for $7.75, 25 pounds of coffee for $2.50; what will pay for the whole? *Ans.* $15.75.

3 **3.** Gave $1.25 for seven yards of calico, 87 cents for muslin, 75 cents for a pair of gloves; what sum will pay for the whole? *Ans.* $2.87.

4 **4.** A boy went to market, and bought a turkey for $1.12,5, 2 pounds of butter for $0.50, one peck of apples for $0.25, one peck of potatoes for $0.12,5; how much did he spend? *Ans.* $2.00.

5 **5.** Bought a horse for $85, carriage for $103.50, and paid for a whip $1.50; what was the cost of the whole? *Ans.* $190.00.

6 **6.** Bought three bushels of oats for $1.25, five bushels of corn for $2.87,5, nine bushels of wheat for $10.50, three bushels of dried apples for $5.62,5; how much did the whole cost? *Ans.* $20 25.

ENGLISH MONEY.

EXAMPLES FOR PRACTICE.

1

£.	s.	d.	qr.	
6	19	11	3	
9	6	0	2	
3	10	6	2	
7	8	8	1	
27	5	3	0	*Ans.*

2.

£.	s.	d.
125	10	8
821	16	2
104	12	5
215	16	4

APPLICATION.

1. What is the sum of 9£. 16s. 8d., and 10£. 12s. 7d.? *Ans.* 20£. 9s. 3d.

2. A person in London paid 7£. 13s. 6d. for a coat, 2£. 17s. 9d. 1qr. for a vest, 3£. 8s. 3d. for a pair of pantaloons, and 9£. 11s. 8d. 3qr. for a surtout; what was the amount of his bill? *Ans.* 23£ 11s. 3d.

3. Bought 3 bushels of potatoes for 1£. 2s. 4d., and two bushels of wheat for 2£. 15s. 9d.; what sum will pay for the whole? *Ans.* 3£. 18s. 1d.

AVOIRDUPOIS WEIGHT.

EXAMPLES FOR PRACTICE.

1.

T.	cwt.	qr.	lb.	oz.	dr.
1	16	3	27	14	12
5	13	2	21	10	11
6	12	1	16	9	8
7	9	3	5	3	6

2.

cwt.	qr.	lb.	oz.
8	3	26	15
7	2	16	10
3	1	18	12
9	3	14	9

APPLICATION.

1. A merchant bought two hogsheads of sugar, 1 weighed 9cwt. 3qr. 18lb., the other 8cwt. 2qr. 25lb.; what is the weight of both? *Ans.* 18cwt. 2qr. 15lb.

2. Bought three boxes of spice, the first weighing 0cwt. 3qr. 25lb., the second 1cwt. 2qr. 16lb., the third 0cwt. 3qr. 26lb. 15dr.; require the weight of the whole? *Ans.* 3cwt. 2qr. 11lb. 15dr.

3. What is the whole weight of three bags of coffee, each weighing 1cwt. 2qr. 20lb.? *Ans.* 5cwt. 0qr. 4lb.

4. What quantity of hops in 6 bags, the first weighing 0cwt. 2qr. 15lb., and each of the rest 10lb. more? *Ans.* 4cwt 1qr

TROY WEIGHT.

EXAMPLES FOR PRACTICE.

1.

lb.	oz.	dwt.	gr.
7	10	11	15
2	1	8	9
4	6	7	12
5	5	12	10

2.

lb.	oz.	dwt	gr.
21	4	13	16
78	7	6	8
36	5	10	14
63	6	9	10

APPLICATION.

1. What is the sum of 36lb. 7oz. 16dwt., 48lb. 7oz. 0dwt. 16gr. and 56lb. 6oz. *Ans.* 141lb. 8oz. 16dwt. 16gr.

2. A goldsmith bought 7 ingots of silver, three of which weighed 9lb. 7oz. 14dwt., and each of the rest 8lb. 5oz 15dwt. 16gr.; how much did the whole weigh?
Ans. 62lb. 10oz. 1dwt. 16gr

APOTHECARIES' WEIGHT.

EXAMPLES FOR PRACTICE.

1.

℔	℥	ʒ	℈	gr.
6	7	4	1	11
3	4	3	2	9
8	2	1	1	14
1	5	2	0	6

2.

℔	℥	ʒ	℈	gr.
13	10	6	2	13
14	1	2	0	7
15	8	3	1	6
18	5	7	2	19

APPLICATION.

1. What is the sum of 3 ℔ 6 ℥ 4 ʒ 2 ℈, 5 ℔ 8 ℥ 5 ʒ and 7 ℔ 5 ℥ 7 ʒ 2 ℈ 10gr.? *Ans.* 16 ℔ 9 ℥ 1 ʒ 1 ℈ 10gr.

2. A druggist mixed together 3 ℥ 4 ʒ 1 ℈, 4 ℥ 3 ʒ 2 ℈, 0gr., 1 ℈ 18gr., and 6 ℥ 5 ʒ 2 ℈ 16gr.; how much will it all weigh? *Ans.* 1 ℔ 2 ℥ 6 ʒ 1 ℈ 14gr.

LONG MEASURE.

EXAMPLES FOR PRACTICE.

1.

deg.	m.	fur.	p.
4	41	3	31
5	11	4	20
6	27	2	22
4	29	7	35

2.

yds.	ft.	in.	bc
126	2	6	1
215	1	5	2
165	2	6	1
240	1	5	2

APPLICATION.

1. A boy has three balls of twine, the first measuring

120yds. 2ft. 6in., the second 95yds. 3ft. 2in., and the third 75yds. 0ft. 4in.; how many yards had he in the whole? *Ans.* 292yds.

2. A vessel sailed for three days, as follows: the first day 1deg. 29m. 3fur. 30p., on the second 2deg. 3m. 3fur., on the third 1deg. 6m. 7fur. 35p.; how far did she sail in that time? *Ans.* 4deg. 39m. 6fur. 25p

CLOTH MEASURE.

Examples for Practice.

1.

yds.	qr.	na.
77	3	1
25	2	2
61	3	3
25	3	2

2.

E. E.	qr.	na.
66	4	3
33	3	2
40	2	3
25	3	1

Application.

1. A man bought three pieces of cloth, each containing 35yds. 3qr. 1na.; how many yards in the whole? *Ans.* 107yds. 1qr. 3na.

2. A draper bought six bales of cloth, 3 of which contained each 225yds. 2qr. 2na., 2 of the remainder contained each 195yds. 3qr. 1na., and the sixth contained 209yds. 2qr. 1na.; how many yards in the whole? *Ans.* 1,278yds. 0qr. 1na.

LAND OR SQUARE MEASURE.

Examples for Practice

1.

	yds.	ft.	in.
	97	4	104
	22	3	27
	105	8	2
	37	7	127
Ans.	263	5	116

2.

m.	a.	r.	p.
1	500	3	27
5	375	2	25
7	450	1	31
4	30	0	21

APPLICATION.

1. How many acres in 3 fields, each containing 25a. 2r. 36p? *Ans.* 77a. 0r. 28p.

2. A man has a field of wheat containing 15a. 1r. 25p., another of rye containing 11a. 3r. 15p.: another of oats containing 9a. 2r. 29p., and a fourth of meadow, containing 21a. 0r. 39p.; what quantity of land does he hold? *Ans.* 58a. 0r. 28p.

CUBIC MEASURE.

EXAMPLES FOR PRACTICE.

1.

yds.	ft.	in.
65	25	1129
37	26	182
50	1	1064
22	19	17
176	18	614

2.

cords.	ft.	in.
87	9	125
8	6	986
21	95	1042
5	25	622

APPLICATION.

1. A man bought 3 pieces of timber, each containing 5ft. 950in.; what was the cubical contents of the whole? *Ans.* 16 ft. 1122in.

2. What is the solid contents of 2 pieces of square timber, each containing 150ft. 1728in. *Ans.* 302ft. 00in.

WINE AND ALE MEASURE.

EXAMPLES FOR PRACTICE.

1.

tun.	hhd.	gal.	qt.
12	1	45	3
10	3	52	1
9	2	15	2
3	1	18	1

2.

hhd.	gal.	qt.	pt.
120	39	2	1
95	35	3	1
106	21	2	0
50	9	3	1

APPLICATION.

1. Sold 3 casks of brandy, containing each 47gal. 3qt. 1pt.; now many gallons in all? *Ans.* 143gal. 2qt. 1pt.

2. Bought 3 barrels of cider and 1 of beer, each containing 31gal. 3qt. 1pt.; how many gallons did I buy? *Ans.* 127gal. 2qt

3. Bought 4 vessels of wine, each containing 185gal. 3qt. 1pt; what quantity of wine did I buy? *Ans.* 743gal. 2qt. 0pt

DRY MEASURE.

EXAMPLES FOR PRACTICE.

1.

bu.	pk.	qt.	pt.
25	3	7	1
21	2	6	3
1	2	7	1
5	2	5	2

2.

bu.	pk.	qt.	pt.
125	3	6	1
185	2	5	1
95	3	1	0
5	1	4	1

APPLICATION.

1. My granary contains 59bu. 4qt., and I put into it at one time 14bu. 2pk. 5qt.: at another, 23bu. 3pk.; at another, 8bu. 7qt.; at another, 19bu. 1pk. How many bushels does it now contain? *Ans.* 125 bushels.

2. A man bought 9 bags of potatoes, each bag containing 2bu. 3pk.; how many bushels did he buy? *Ans.* 24bu 3pk

3. In 6 bags of beans, each containing 2bu. 3qt. 1pt., how many bushels? *Ans.* 12bu. 2pk. 5qt

TIME.

EXAMPLES FOR PRACTICE.

1.

y.	m.	w	d.
9	10	2	4
5	11	3	5
4	9	2	1
9	6	1	6

2.

d.	h.	min	sec.
135	20	41	52
150	21	52	16
95	15	19	17
5	16	6	5

APPLICATION.

1. A boy served as an apprentice to one man 2y. 6mo 3w. 21d.; to another, 1y. 8mo. 1w. 5d.; to a third, 3y. 4mo 0w. 6d.; how long did he serve altogether? *Ans.* 7y. 7mo. 1w. 4d

2 From the tenth of the third month to the tenth of the eighth month inclusive, how many days? *Ans.* 154 days.

CIRCULAR MEASURE.

EXAMPLES FOR PRACTICE.

1.

°	′	″
6	28	43
3	21	17
4	20	30
1	39	49

2.

sig.	°	′	″
1	14	46	51
1	15	18	27
1	12	41	33
1	17	54	43

SECTION X.

COMPOUND SUBTRACTION.

ART. 52. COMPOUND SUBTRACTION teaches the method of finding the difference between numbers of several denominations.

Ex. Let it be required to subtract 5£. 16s. 8d. 2qr. from 8£. 18s. 4d. 3qr.

£.	s.	d.	qr.
8	18	4	3
5	16	8	2
3	1	8	1

Having placed the less number under the greater, with farthings under farthings, pence under pence, &c., we begin with the quarters or farthings, and say: 2 from 3 leaves 1, which we write under the column of quarters. Now, as we cannot take 8d. from 4d., we must take it from 12d., the number of pence in one shilling, and add the remainder 4d. to the 4d. of the minuend, and place their sum under the column of pence. But as we took 1s. from the 18s., we have diminished their number by 1; therefore, to compensate for this, we add or carry 1s. to the 16s. of the minuend, and say 1 to 6 makes 7; then subtract 17s. from 18s. and 1s. remains; we write this under the column of shillings, and take 5 from 8, and we have the answer, 3£. 1s. 8d. 1qr.

QUESTIONS.—Art. 52. What is Compound Subtraction? Explain the example.

Art. **53.** From the preceding illustration, we deduce the following rule for the subtraction of compound numbers:

RULE.

I. *Write the numbers of the different denominations, directly under those from which they are to be taken.*

II. *Then, if the lower number be less than the upper, subtract it as in simple subtraction, and place the difference under that number. But when the lower number is greater than the upper, subtract it from as many units as will make one of the next greater denomination, and to the remainder add the upper number.*

III. *Set down the result, and carry one to the next number of the subtrahend.*

Proof.—Add the difference to the subtrahend, and the sum will be equal to the minuend, if the work be correct

Note.—Dollars, cents and mills may be subtracted the same as simple numbers, according to the rule for simple subtraction. See Art. 18

UNITED STATES MONEY.

Examples for Practice.

1.	2.	3.
$. cts. m.	$. cts. m.	$. cts.
125.87,5	826.25,2	1252.50
98.25,9	625.87,5	987.75
27.61,6 *Ans.*		

Application.

1. A man owed me a bill of $15.25, and paid $9.87,5, how much does he still owe me? *Ans.* $5.37,5.

2. A man owed his landlord for rent, $13.87,5, and paid him $7.50, what balance does he owe yet? *Ans.* $6.37,5.

3. A lady bought from a man in market, one pound of butter for 12½cts., and gave him a five dollar note; what change must she receive? *Ans.* $4.87½

Questions.—Art. 53. What is the rule for Compound Subtraction The proof?

4. A man bought a quantity of groceries for $11.12,5, and paid on them $3.75; how much does he still owe?

Ans. $7.37,5

ENGLISH MONEY.

EXAMPLES FOR PRACTICE.

1.

£.	s.	d.
192	16	3
75	18	9
116	17	6

2.

£.	s.	d.	qr.
183	9	6	1
125	10	8	2

APPLICATION.

1 A man owed a bill of 9£. 16s. 8d., and paid 6£. 10s. 9d.; what balance does he yet owe? *Ans.* 3£. 5s. 11d.

2. A man had 100£. and spent 87£. 15s. 8d.; how much has he left? *Ans.* 12£. 4s. 4d.

AVOIRDUPOIS WEIGHT.

EXAMPLES FOR PRACTICE.

1

T.	cwt.	qr.	lb.
18	1	3	14
4	12	2	27
13	9	0	15

2.

cwt.	qr.	lb.	oz.	dr.
18	2	15	8	10
15	3	25	15	14

APPLICATION.

1. Bought 4cwt., 1qr., 7lb. of sugar; and sold 3cwt., 2 qr 26lb., what remains? *Ans.* 0cwt. 2qr. 9lb.

2. Bought 4 boxes of raisins, each weighing 1qr. 15lb. 5oz., and sold one box: what quantity remains?

Ans. 1cwt. 0qr. 17lbs. 15oz.

3. A man engaged to remove 25 tons of iron, and after removing 15 tons, 12cwt. 3qr. 25lbs.; how much had he to remove yet? *Ans.* 9 tons, 7cwt. 0qr. 3lbs.

4. Bought 7cwt. 1qr. 10lb. of coffee, and sold 5cwt. 2qr. 20lb.; how much remains? *Ans.* 1cwt. 2qr. 18lbs

TROY WEIGHT.

Examples for Practice.

1.

lb.	oz.	dwt.	gr.
27	0	11	10
9	8	1	18
17	4	9	16

2.

lb.	oz.	dwt.	gr
29	6	15	20
18	5	18	15

Application.

Bought 4 ingots of silver weighing 150lb. 6oz. 10dwt., and sold 2 of them weighing 85lb. 9oz. 15dwt. 21gr.; what was the weight of the other two? *Ans.* 64lbs. 8oz. 14dwt. 3gr.

APOTHECARIES' WEIGHT

Examples for Practice.

1.

℔.	℥.	ʒ.	℈.	gr.
9	1	8	2	15
6	9	7	1	19
2	4	1	0	16

2.

℔.	℥.	ʒ.	℈.	gr.
12	10	7	1	18
10	9	2	2	19

Application.

If from 5lb. 6oz. 1dr. 2sc., I take 3lb. 8oz. 6dr. 0sc. 14 qr.; how much is left? *Ans.* 1lb. 9oz. 3dr. 1sc 6gr.

LONG MEASURE.

Examples for Practice.

1.

deg.	m.	fur.	rd.
21	40	6	27
15	59	7	21
5	40	7	6

2.

yd.	ft.	in.	bc.
67	2	1	1
53	2	9	2

APPLICATION.

1. From 50lea. 2m., 1 fur., take 19lea. 0m. 0fur. 18rd. 4yd.; what remains? *Ans.* 31lea. 2m. 0fur. 21rd. 1¼yd.

2. Two men started on a journey, and at the end of a certain period, the first had travelled 215m. 3fur. and 21rd., and the second had travelled 198m. 7fur. and 35rd.; how far were they asunder? *Ans.* 16m. 3fur. 26rd.

CLOTH MEASURE.

EXAMPLES FOR PRACTICE.

1.

yds.	qr.	na
47	2	1
19	3	2
27	2	3

2.

EE.	qr.	na.
85	3	2
54	4	1

APPLICATION.

1. Bought a piece of cloth containing 37yd. 2qr. 1 na., and sold from it 25yd. 3qr. 3na.; how much remains? *Ans.* 11yds. 2qr. 2na.

2. Bought 4 pieces of cloth, 225yds., two of the pieces contained 147yd. 3qr. 2na.; how much did the other two contain? *Ans.* 77yds. 0qr. 2na.

3. From 54EE. 2qr., take 25EE. 3qr. 2na.; and tell the remainder? *Ans.* 28EE. 3qr. 2na.

LAND OR SQUARE MEASURE.

EXAMPLES FOR PRACTICE.

1.

A.	R.	P.
45	2	17
19	3	36
25	2	21

2.

yds.	ft.	in.
197	4	105
29	6	135

APPLICATION.

1. A man has two fields, the one contains 18A. 2R. 21P., the other 15A. 3R. 29P.; what is the difference between them? *Ans.* 2A. 2R. 32P.

CUBIC MEASURE.

Examples for Practice.

(1.)	yds.	ft.	in.
	65	20	1252
	55	26	956
	9	21	296

(2.)	yds.	ft.	in.
	125	5	6
	104	25	1165

Application.

Bought a piece of square timber containing 25 cubic feet and 1,585 inches, and having cut off 15 cubic ft. and 1,695 cubic inches; what quantity remains? *Ans.* 9cu.ft. 1,618in.

WINE AND ALE MEASURE.

Examples for Practice.

1.

tuns.	hhd.	gal.	qt.
21	1	45	2
15	3	25	3
5	2	19	3

2.

hhd.	gals.	qt.	pt.
17	28	1	0
9	60	2	1

Application.

1. From 2 tuns take 3hhd. 15gal. 3qt. *Ans.* 1tun 47gal. 1qt

2. Bought one cask of wine containing 176gal., but by accident 7gal. 3qt. 1pt. were lost; how many gallons remain? *Ans.* 168gal. 0qt. 1pt.

3. From one hogshead of cider, take 25gal. 3qt. 1pt., and tell what remains? *Ans.* 28gal. 0qt. 1pt.

4. If from 1hhd. of wine I take 1pt., how much remains? *Ans.* 62gal. 3qt. 1pt.

5. Bought one barrel of cider, and sold 25gals.; how much remains? *Ans.* 6gal. 2qt.

DRY MEASURE.

Examples for Practice.

1.

bu.	pk.	qt.
781	1	6
652	3	7
128	1	7

2.

bu.	pk.	qt.
1854	3	4
998	3	7

APPLICATION.

1. Bought 85bu. 2pk. of oats, and sold 45bu. 1pk. 6qt.: what quantity remains? *Ans.* 40bu. 0pk. 2qt.

2. Bought 4 bags of corn, containing 12bu. 3pk. 5qt., two bags contained 6bu. 3pk. 6qt.; what did the other two contain? *Ans.* 5bu. 3pk. 7qt.

3. Out of a granary containing 500bu., I take 375bu. 2pk. 6qt.. what quantity remains? *Ans.* 124bu. 1pk. 2qt.

TIME.

EXAMPLES FOR PRACTICE.

1.

y.	mo.	w.	d.
1789	6	2	5
985	2	1	4
804	4	1	1

2.

d.	h.	min.	sec
150	21	59	40
125	23	25	58

APPLICATION.

1. A boy had to serve as an apprentice 5 years, and when he had served 3y. 9mo. 3w. 5d., how long had he to serve yet? *Ans.* 1y. 2mo. 0w. 2d.

2. Jacob engaged to serve Laban for his two daughters 14 years, and when he had accomplished 11y. 6mo. 3w. 3d. how long had he yet to serve? *Ans.* 2y. 5mo. 0w. 4d.

3. John is 15y. 8mo. 2w. of age, and Francis is 11y. 9mo. 3w. 6d. of age; what is the difference between their ages? *Ans.* 3y. 10mo. 2w. 1d.

ART. 54. To find the time between different dates.

RULE.

Write the less date under the greater, with the number of the month in the less date under that of the greater, and the days of the less date under those of the greater: then subtract as in compound subtraction.

NOTE.—It is customary in calculating interest to reckon 30 days to each month, and 12 months to the year.

QUESTIONS.—Art. 54. What is the rule to find the time between dates? Explain the operation?

EXAMPLES FOR PRACTICE.

1. What is the time from July 10, 1843, to January 4 1845.

OPERATION.

	y.	mo.	d.
	1845	1	4
	1843	7	10
The time	1	5	24

In this example we first set down 1845, the greater date, and wrote one for the months, January being the first month, and 4 for the days. Under this we wrote the less date, and 7 for the months, July being the seventh, and 10 for the days; then subtracted as in compound subtraction.

2. What is the time from June 15, 1846, to January 10, 1848? *Ans.* 1y. 6mo. 25d.

3. What is the time from April 20, 1848, to August 1, 1849? *Ans.* 1y. 3mo. 11d.

4. John was born March 9, 1838, and Henry September 15, 1845; what is the difference between their ages? *Ans.* 7y. 6mo. 6d

CIRCULAR MEASURE.

EXAMPLES FOR PRACTICE.

1.

s.	°	′	″
11	7	13	15
9	29	17	36
1	7	55	39

2.

s.	°	′	″
10	18	49	12
6	20	21	46

APPLICATION.

When a planet has moved through 9s. 9° 9′ 9″ of its orbit, how far has it to go to complete its revolution? *Ans.* 2s. 20° 50′ 51

ART. **55.** Since the circumference of the earth is 360° and the earth revolves on its axis once in every 24 hours, it follows that the earth in its motion from east to west, accom-

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QUESTIONS.—Art. 55. Since the circumference of the earth, &c. what follows? From this what is evident? What is the rule &c ?

plishes 15° in one hour of time; and consequently 1° in every four minutes of time, and 1′ in 4 seconds of time.

From this it is evident, that when there is a difference in longitude between two places, there will be a corresponding difference in the hour of time, or of the time of day.

Thus, when the sun rises at 5 o'clock in the city of Baltimore, it will rise one hour sooner 15° further towards the east, because the earth, on its daily motion, passes over 15° in one hour of time; for the same reason, it will rise one hour later 15° to the west.

Hence, if the difference in longitude, in degrees and minutes between two places be given, the difference in time, in minutes and seconds, may be found by the following

RULE.

Multiply the difference in longitude by 4, and the product will be the difference in time, in minutes and seconds, which may be reduced to hours.

NOTE.—By this rule persons may regulate their time-pieces, when travelling east or west. Thus, in going eastwardly from any place, if the difference in longitude were found to be 1°, the difference in time would be 4 minutes.

Ex. The difference in longitude between Washington, D. C., and Nashville, Tenn., is 10°; what o'clock is it at Nashville when it is 12 o'clock at Washington?

OPERATION	h. m.	
10°	12 0	We multiplied the degrees by 4, which gave 40 minutes. This subtracted from 12 hours, left 11h. 20m., or 40 minutes of 12 o'clock.
4	0 40	
40 minutes of 12 o'clock.	11h. 20m.	

EXAMPLES FOR PRACTICE.

1. San Francisco is 45° W. longitude from the city of Washington; when it is 12 o'clock at Washington, what is the hour in San Francisco? *Ans.* 9 o'clock

2 Boston is 6° 40′ E. longitude from the city of Wash

ington; when it is 3 o'clock in the latter city, what time is it in Boston? *Ans.* 26m. 40sec. past 3 o'clock.

3. What will a correct time-piece gain, going from Baltimore to Philadelphia, the latter city being about 1° E. longitude from Baltimore? *Ans.* 4 minutes.

MISCELLANEOUS EXERCISES IN COMPOUND ADDITION AND SUBTRACTION.

1. A man had owing to him a bond for $1854.87, interest due thereon $350.50, and received in payment $1580.50, what is yet due? *Ans.* $624.87.

2. A merchant owed a company in London 15486£. 10s. 6d., and interest due thereon 1240£. 15s. 6d., and paid at one time 9500£. at another 5400£. 12s. 8d.; what amount does he yet owe? *Ans.* 1826£. 13s. 4d.

3. Bought 3 hogsheads of tobacco, each weighing 9cwt. 2qr. 14lb., and sold 15cwt. 3qr. 25lb.; what quantity remains? *Ann.* 12cwt. 3qr. 17lb.

4. Bought 5 barrels of apples, each barrel containing 2bu. 1pk., and sold 6 bushels, how many bushels remain? *Ans.* 5bu. 1pk.

5. Bought two hogsheads of molasses, one containing 65 gallons 2qt. 1pt., the other 87gal. 3qt. 1pt., and sold 47gal. 3qt.; how many gallons remain? *Ans.* 105gal. 3qt. 0pt.

SECTION XI.

COMPOUND MULTIPLICATION.

ART. **56.** COMPOUND MULTIPLICATION teaches the method of multiplying numbers or quantities of different denominations.

Ex. 1. Let it be required to multiply $5.25,5 by 4.

OPERATION.

Multiplicand $5.25,5
Multiplier 4
Product 21.02,0

As dollars, cents and mills increase from right to left in a tenfold proportion, they are multiplied exactly as numbers in simple multiplication. See Art. 24. Hence, in this example, we multiply the 5 mills by 4, placing the cipher under the column of mills, and carry 2 to the cents, &c.

Ex. 2. Let it be required to multiply £5. 9s. 5d. by 3.

OPERATION.

	£.	s.	d.
Multiplicand	5	9	5
Multiplier			3
Product	16	8	3

In this example, we multiply the 5d. by 3, and the product is 15d. We do not write down the whole 15d., but we divide it by 12, the number of pence in one shilling, in order to reduce it to shillings. (See *Reduction*, Art. 42.) In 15d there is 1 shilling and 3d. over; write what is over under the pence, and carry the one to shillings. Again, 3 times 9 are 27s., and the one we carried makes 28. We divide this by 20, the number of shillings in one pound. We find that 20 is contained in 28 once and 8 over; again write what is over under the shillings, and carry the one to pounds. Lastly, 3 times 5 are 15, and the 1 carried forms 16. Hence the product is 16£. 8s. 3d.

NOTE.—When the multiplier is greater than 12, the operation may be performed by the rule for *composite* numbers. (Art. 30.)

ART. **57.** From the preceding illustration, we deduce the following general rule for Compound Multiplication:

RULE.

I. *Begin with the lowest denomination of the compound number, and multiply each denomination separately; then divide the product by as many units as make one of the next higher denomination.*

II. *Write down the remainder, if any, under the denomination last multiplied, and add the quotient to the next denomination, and so proceed until all the denominations of the compound number are multiplied.*

QUESTIONS.—Art. 56. What does Compound Multiplication teach? Explain the examples. What is observed in the *note?*—Art. 57. What is the rule?

EXAMPLES FOR PRACTICE.

UNITED STATES MONEY.

1.	2.	3.
$125.50	$75.75,5	$85.62,5
4	7	15
502.00		

APPLICATION.

1. What will 43 dozen of eggs cost, at $0.17 per dozen? *Ans.* $7.31

2. What will 27 yards of cloth cost, at $2.75 per yard? *Ans.* $74.25

3. What will 19 bushels of salt cost, at $1.62,5 per bushel? *Ans.* $30.87,5

4. Bought 35 cords of wood, at $4.25 per cord, what is the amount? *Ans.* $148.75.

5. A man bought 785 pounds of pork, at 7 cents per pound, what sum will pay for it? *Ans.* $54.95.

6. Bought 95 pounds of tea, at $0.87,5 per pound, how much will it come to? *Ans.* $83.12,5.

7. Sold 15 gallons of wine, at $1.75 per gallon, what is the amount? *Ans.* $26.25.

8. Sold one barrel of oil, at $0.75 per gallon, what is the amount? *Ans.* $23.62,5

9. Bought 125 bushels of potatoes, at $0.87,5 per bushel, what sum will pay for them? *Ans.* $109.37,5.

10. Sold 59 yards, at $1.03 per yard, what is the amount? *Ans.* $60.77

11. What does a man earn in a year, at $1.12,5 per day? *Ans.* $410.62,5.

12. What is the yearly rent of a house, at $0.35 per day? *Ans.* $127.75.

13. What does a man earn in a year, at $0.75 per day working 6 days in each week? *Ans.* $234.75

14. A certain house makes 185 yards of carpeting per day; how many yards will it make in a year, allowing 6 days to the week? And what will the carpeting cost, at $0.62,5 per yard? *Ans.* 57,905yds. $36,190.62,5

ENGLISH MONEY.

Examples for Practice.

1

£.	s.	d.	qr.
24	16	4	2
			2
49	12	9	0

2.

£.	s.	d.	qr
987	15	10	3
			4

Application.

1. If one piece of linen cost 3£. 18s. 6d., what will three pieces cost at that rate? *Ans.* 11£. 15s. 6d.

2. If the rent of a room be 1£. 6s. 8d. per month, what will that be for a year? *Ans.* 16£. 0s. 0d.

3. If one bushel of potatoes cost 5s. 6d., what will 24 bushels cost at that rate? *Ans.* 6£. 12s. 0d.

Note.—It will not be necessary to give examples under all the tables of Weights and Measures, as the mode of operation is the same throughout the whole.

AVOIRDUPOIS WEIGHT.

Examples for Practice.

1.

qr.	lb.	oz.	dr.
3	21	10	8
			4

2.

cwt.	qr.	lb.	oz.	dr.
16	3	10	12	9
				6

Application.

Bought 9 bags of coffee, each weighing 1cwt 2qr. 21lb 9oz., what is the weight of the whole? *Ans.* 15cwt. 0qr. 26lb. 1oz

DRY MEASURE.

1.

bu.	pk.	qt.
20	3	6
		4

2

bu.	pk.	qt.
125	2	5
		9

WINE AND ALE MEASURE.

1.

tuns	hhd.	gal.	qt.
3	2	20	3
			4

2.

gal.	qt.	pt.
125	3	1
		9

CLOTH MEASURE.

1.

yds.	qr.	na.
25	3	2
		4

2.

E.E.	qr.	na
52	4	3
		8

SECTION XII.

COMPOUND DIVISION.

Art. 58. Compound Division teaches the method of dividing numbers of different denominations.

Ex. 1. Let it be required to divide $25.50 by 5.

OPERATION.

Divisor 5)25.50 *Dividend.*

5.10 *Quotient.*

In dividing dollars, cents, and mills, the operation is performed by the rules for simple division. (See Art. 35.) Care must be taken, however, *to insert in the Quotient* the POINT, or PERIOD between the *dollars* and the *cents,* and the COMMA between cents and mills.

Note.—Whenever the divisor passes over the *point* in the dividend, the *point* must be inserted in the *quotient.*

Ex. 2. Let it be required to divide 11£. 6s. 3d. by 5.

OPERATION.

	£.	s.	d.	
Divisor 5)	11	6	3	*Dividend.*
	2	5	3	*Quotient.*

After arranging the figures as seen in the example, we divide the 5 into 11 pounds; we find it contained twice, and one over We write 2, the quotient, under the

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Questions.—Art. 58. What does compound division teach? Explain the examples. When the divisor passes over the *point,* what must be done? What is the rule?

pounds, and reduce the pound that was over to shillings, and to their number, we add the 6 shillings of the dividend, the sum is 26. Now, we divide this number by 5, the divisor, and the quotient is 5 shillings and 1 over. Again, we write 5, the quotient, under the shillings, and reduce the 1 shilling that was over to pence, and to their number, we add the 3 pence of the dividend, and the sum is 15. Lastly, we divide this number by 5, the divisor, and write the quotient 3 under the pence. Thus we find the quotient to be 2£. 5s. 3d.

From the above illustration, we deduce the following

RULE.

Write the divisor on the left of the number to be divided, and divide the highest denomination by it; if there be any remainder, reduce it to the next lower denomination, and divide as before, and so continue the operation until you have passed through all the denominations.

DIVISION OF UNITED STATES MONEY.

Art. **59.** When the price of a number of articles, such as yards, pounds, gallons, &c., is given, the price of *one* article of the same kind, may be found by the following

Rule.—*Divide the price of the whole by the number of articles, and the quotient will be the price of one article.*

Examples for Practice.

1 Divide $18.27 by 3. *Ans.* $6.09.

2. Divide $125.50 by 5 *Ans.* $25.10.

3. Divide $832.80 by 8. *Ans.* 104.10.

4. Divide $553.12,5 by 14. *Ans.* 39.508+

5. Divide $701.31,5 by 25. *Ans.* $28.05,2.

6. If 5 pounds of sugar cost 40cts., what is the price of 1 pound? *Ans.* 8cts.

7. If 25 yards of muslin cost $2.75, what is the price of one yard? *Ans.* $0.11.

8. If a farm of 125 acres cost $4000, what was it per acre? *Ans.* $32.

Question.—Art. 59. When the price, &c. is given, what is the *rule*?

9. If a man earn $175.50 in 8 months, how much was that per month? *Ans.* $21.93¾

10. Bought 320 pounds of butter for $42.50, what is the price of one pound? *Ans.* 0.13$\frac{9}{32}$.

11. Paid $110.50 for 20 barrels of flour, what is the price of one barrel? *Ans.* $5.52½.

12. Bought 205 pounds of beef for $16.40, how much was that per pound? *Ans.* 8 cents.

13. If a man's annual income be $730, how much is that per day? *Ans.* $2.

14. Sold 120 bushels of wheat for $135, what was the price per bushel? *Ans.* $1.12,5.

15. Bought 48cwt. of iron for $384, what was the price per cwt.? *Ans.* $8.

16. Sold 450 bushels of oats for $180, how much was that per bushel? *Ans.* $0.40.

17. Paid $144.40 for 40 dozen of port wine; what was the price per doz. and per bottle?
Ans. $3.61 per doz. and 0.30\frac{1}{12}$per bot.

18. Paid $8 for a barrel of beer; what is the price of one quart? *Ans.* $0.06¼ nearly.

19. A man bought 20 bales of muslin, each bale containing 35 yards, for $150.50; how much did he pay per yard? *Ans.* $0.21½.

20. A man left $9,540.25, and directed that $1000 should be given for charitable purposes, and the rest to be divided equally between 5 sons, 4 daughters, 7 nephews, and 3 neices; how much did each receive? *Ans.* 449.48\frac{13}{19}$.

21. If 112 pounds of soap cost $9.52, what is the cost per pound? *Ans.* $0.08½.

22. If 163 buckets cost $197.23, what is the price per bucket? *Ans.* $1.21

23. The expense of a family for 365 days was $1,460; how much was that per day? *Ans.* $4.00

24. If 78 barrels of fish cost $303.42, what will one barrel cost? *Ans.* $3.89

25. Sold 789 pounds of leather for $142.02; what did it cost per pound? *Ans.* $0.18

ENGLISH MONEY.

Examples for Practice.

1.
£. s. d.
3)9866 19 11

2.
£. s d.
7)7957 16 8

Application.

1. Bought 4 bushels of potatoes for 18s. 4d.; what was the cost per bushel? *Ans.* 4s. 7d.

2. If 58lbs. of sugar be sold for 2£. 10s. 3d.; what was that per lb.? *Ans.* 10¼d., nearly.

3. What is the value of 1yd. of cloth, when 84 yards of the same kind cost 36£. 13s. 3d.? *Ans.* 8s. 8¾d.

4. If 48 pieces of cloth cost 216£.; what is the value of one piece? *Ans.* 4£. 10s. 0d

AVOIRDUPOIS WEIGHT.

1.
lb. oz. dr.
5)36 10 9

2.
cwt. qr. lb. oz.
4)9 3 21 12

3.
T. cwt. qr. lb.
8)91 16 2 24

LIQUID MEASURE.

1.
gal. qt. pt.
3)121 3 1

2.
gal. qt. pt.
6)742 3 0

3.
T. hhd. gal.
8)9 2 40

DRY MEASURE.

1.
bu. pk. qt.
4)13 2 6

2.
bu. pk. qt.
8)60 3 5

3.
bu. pk. qt.
10)1436 1 2

Note.—When the divisor is a composite number, and greater than 12, *divide by the factors successively.*

Ex. Let it be required to divide 57yds. 2qr. 0na. by 24.

OPERATION.

	yd	qr.	na.	
4)	57	2	0	24=4×6
6)	14	1	1	
	2	1	$2\frac{1}{3}$	

In this example we first divided by 4, one of the factors of 24; and then divided the quotient by 6, the other factor of 24. The same process may be observed for any composite number.

Note.—If the divisor be very large, or a number that has no common factors, the most convenient method of performing the operation would be, *to reduce the dividend to its lowest given denomination, then divide it by the divisor as in whole numbers.* The result will be the answer in that denomination to which it was reduced. This may be reduced to a higher denomination if necessary.

Examples for Practice.

1. Bought 60yds. of cloth for 72£. 14s. 0d.; what did it cost per yard? *Ans.* 1£. 4s. $2\frac{4}{5}$d

2. A man has 203 bushels of wheat, and wishes to put it in 56 bags; how many bushels will each bag contain? *Ans.* 3bu. 2pk. 4qt.

3. If 64 gallons of wine cost 30£. 8s.; what did it cost per gallon? *Ans.* 9s. 6d.

4. If I divide 108 acres in 24 equal parts; how much in each part? *Ans.* 4A. 2R.

5. Divide 96£. by 144? *Ans.* 13s. 4d.

SECTION XIII.

COMMON DIVISOR.

Art. **60.** A Common Divisor of two or more numbers, is any number that will divide them without a remainder. Thus, 3 is a common divisor of 3, 6, 9 and 12.

To find a common divisor of two or more numbers, we have the following

RULE.

Resolve each of the given numbers into two factors, one of which is common to all of them; this common factor will be the common divisor

Ex. What is the common divisor of 10, 15 and 25?

OPERATION.

$10 = 5 \times 2$

$15 = 5 \times 3$

$25 = 5 \times 5$

We resolve each of the given numbers into two factors, one of which, namely 5, is common to all of them; therefore 5 is the common divisor of all the numbers.

EXAMPLES FOR PRACTICE.

1. What is the common divisor of 9, 18 and 24? *Ans.* 3.
2. What is the common divisor of 4, 16 and 28? *Ans.* 4.
3. What is the common divisor of 14, 21 and 49? *Ans.* 7.
4. What is the common divisor of 16, 24, 40 and 96? *Ans.* 8.

ART. **61.** The greatest common divisor of two or more numbers, is the greatest number that will divide each of them without a remainder.

To find the greatest common divisor, we have the following

RULE.

Divide the greater number by the less, and if there be any remainder, divide the last divisor by it, and so continue to divide the last divisor by the last remainder until nothing remains, and the last divisor is the greatest common divisor.

Ex. Let it be required to find the greatest common divisor of the numbers 48 and 56.

OPERATION.

48)56(1
    48
    ——
    8)48(6
       48

In this example we first divided by 48, the less of the two numbers, and found the quotient 1 and the remainder 8. Again, we divided the last divisor 48, by 8, the remainder, and found the quotient to be 6, without any re-

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*QUESTIONS.—Art. 60. What is a *common divisor?* What is the rule?—Art. 61. What is the *greatest common divisor?* What is the rule for finding, &c.?

mainder; hence 8, the last divisor, is the greatest *common divisor* of the two numbers.

EXAMPLES FOR PRACTICE.

1. What is the greatest common divisor of 85 and 95? *Ans* 5.
2. What is the greatest common divisor of 72 and 168? *Ans.* 24.
3. What is the greatest common divisor of 32 and 172? *Ans.* 4
4. What is the greatest common divisor of 84 and 1,728? *Ans.* 12
5. What is the greatest common divisor of 119 and 121? *Ans.* 1

COMMON MULTIPLE.

ART. **62.** A *multiple* of a number is a number, that can be divided by it without a remainder: Thus 6, is a multiple of 3.

ART. **63.** A *common multiple* of two or more numbers, is a number that can be divided by each of them without a remainder: Thus, 12 is the common multiple of 3 and 4.

ART. **64.** The *least common multiple* of two or more numbers, is the *least* number that can be divided by each of them without a remainder.

ART. **65.** To find the least common multiple, we have the following

RULE.

I. *Place the numbers in a line, and then divide by such a number as will divide* MOST *of the given numbers without a remainder, and set the several quotients with the several undivided numbers in a line beneath; and so continue to divide, until no number greater than unity will divide two or more of them.*

II. *Then multiply all the divisors, quotients, and undivided numbers together, and the product is the least common multiple*

QUESTIONS.—Art. 62. What is a *multiple?*—Art. 63. What is a *common multiple?*—Art. 65. What is the rule for finding, &c.? Explain the example.

NOTE 1.—Care must be taken always to divide by a number that will divide *most* of the given numbers, otherwise a multiple may be obtained which is not the least common multiple.

NOTE 2.—When any number will measure another, it may be cancelled. Thus, if the common multiple of 5, 15, 30, 7, 14, and 28 were required, we might cancel the 5, 15, 7, and 14; because 30 would measure 5 and 15, and 28 would measure 7 and 14.

Ex. What is the least common multiple of 3, 8 and 9?
Ans. 72.

OPERATION.

$$\begin{array}{r|rrr} 3 & 3 & 8 & 9 \\ \hline & 1 & 8 & 3 \end{array}$$

$$3 \times 1 \times 3 \times 8 = 72$$

Having arranged the numbers in a line, we find 3 will divide 2 of them. We then write the quotients 1 and 3 and the undivided number under the line.. Lastly, we multiply the divisor, the quotients, and the undivided number together, and the product 72, is the least common multiple.

EXAMPLES FOR PRACTICE.

1. What is the least common multiple of 8, 4, 3 and 6?
Ans. 24.
2. What is the least common multiple of 21 and 49?
Ans. 147.
3. What is the least common multiple of 2, 7, 5, 6 and 8?
Ans. 840.
4. What is the least common multiple of 12, 4 and 7?
Ans. 84.
5. What is the least common multiple of 7, 14, 21 and 15?
Ans. 210.
6. What is the least common multiple of 6, 96, 14 and 18?
Ans. 2016.
7. What is the least common multiple of 3, 4, 5, 6 and 7?
Ans. 420.
8. What is the least common multiple of 4, 14, 28 and 98?
Ans.

SECTION XIV.

FRACTIONS.

ART. **66.** A FRACTION is an expression, which denotes a part of any number or thing. The term fraction is derived from the Latin word *frango*, which signifies to *break*, or to separate into parts.

A fraction is represented by two numbers, the one written above the other, with a line between them. Thus, $\frac{1}{2}$, is read *one half* $\frac{1}{4}$, *one fourth*, $\frac{2}{3}$, *two thirds*.

The number *above* the line is called the *Numerator;* and the number *below*, is called the *Denominator*:

$$\text{Thus} \begin{cases} \text{Numerator} & \frac{3}{4} \ \ \textit{three} \\ \text{Denominator} & \ \ \ \ \ \ \textit{fourths} \end{cases}$$

The *denominator* shows into how many parts the whole number is divided; and the numerator shows how many of these parts are taken; as $\frac{1}{4}$, read *one fourth*, of an *apple*. This expression shows that the apple is divided into *four* parts, and that *one* of the parts is taken.

Fractions are of two kinds, *Decimal* and *Vulgar*.

SECTION XV.

DECIMAL FRACTIONS.

ART. **67.** A DECIMAL FRACTION is a fraction whose denominator is 10, 100, 1000, &c.

Decimal fractions are formed by dividing the *unit* into 10 equal parts, called *tenths;* or into a 100 parts, called *hundredths;* or into a 1000 equal parts, called *thousandths*, and so on indefinitely. Thus, $1 \div 10 = .1$, and $1 \div 100 = .01$, and $1 \div 1000 = 001$, &c.

QUESTIONS.—Art. 66. What is a fraction? What is the term fraction derived from? How is a fraction represented? What is the number above the line called? The number below the line? What does the denominator show? What does the numerator show? How many kinds of fractions?—Art. 67. What is a decimal fraction? How are decimal fractions formed?

Decimal Fractions are written without any denominator, and with a period or point on the left of them, called the *decimal point.* Thus,

$\frac{5}{10}$ is written and read .5 tenths.
$\frac{25}{100}$ " " .25 hundredths.
$\frac{125}{1000}$ " " .125 thousandths.

Art. **68.** In the notation of whole numbers, the value of the figures increases in a tenfold proportion from the right to the left; but in decimals, their value decreases in a tenfold proportion from the left hand to the right.

Hence the *first* figure on the right hand of the decimal point, is *tenths;* the second, *hundredths;* the third, *thousandths*, &c.

Art. **69.** If ciphers be placed on the left hand of decimal figures, their value *is decreased tenfold:* as, .03 = $\frac{03}{100}$; and .003 = $\frac{003}{1000}$, three thousandths, &c. But ciphers placed on the right hand of decimal figures *do not alter their value:* as, .3 = $\frac{3}{10}$, and $\frac{30}{100}$ = $\frac{3}{10}$ = .3.

A whole number and a decimal, written together, is called a *mixed number:* as, 75.5, read seventy-five and five-tenths. When dollars and cents are written together, the dollars are the whole numbers, and cents are decimals, and should always be written with the decimal point between them: as $9.10, read *nine dollars* and *ten cents.*

NOTATION OF DECIMAL FRACTIONS.

Art. **70.** Unity may be considered a fixed point from which whole numbers infinitely increase in value, proceeding from right to left; and from which decimals decrease infinitely, proceeding from left to right.

Questions.—Art. 67. How are decimal fractions written?—Art. 68. In the notation of whole numbers, what is said? But in decimals? What is the first figure, &c.?—Art. 69. If ciphers be placed on the left hand, &c., what is said? But ciphers on the right? What is a whole number and a decimal written together called? When dollars and cents are written together, what is said?—Art. 70. What may unity be considered? Explain the table?

This principle will be exemplified by the following

TABLE.

Hundreds of Millions.	Tens of Millions.	Millions.	Hundreds of Thousands.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Units.	Tenths.	Hundredths.	Thousandths.	Ten Thousandths.	Hundred Thousandths.	Millionths.	Ten Millionths.	Hundred Millionths.
9	8	7	6	5	4	3	2	1.	2	3	4	5	6	7	8	9

Whole Numbers. Decimals

Let the pupil be required to write in words, or read the following numbers:

1. .5.
2. .25.
3. .909.
4. 7625.
5. .0005.
6 5.5.
7. 25.75.
8. 125.125.
9. 8726.095.
10. 1283.2018.

Art. **71.** As decimals increase from right to left and decrease from left to right, in the same ratio as whole numbers, they may be *added, subtracted, multiplied* and *divided* in the same manner.

SECTION XVI.

ADDITION OF DECIMALS.

Art. **72.** RULE.

Write the numbers so that the DECIMAL POINTS *may stand exactly under each other, then add up the columns of figures as in the addition of whole numbers, and place the decimal point in the sum exactly under those in the figures added.*

Question.—Art. 71. As decimals increase &c., what is said?

EXAMPLES FOR PRACTICE.

1	2.	3.
$	yds.	ft.
25.52	15.25	2.35
1.05	9.5	25.9
0.75	11.91	4.12
5.875	3.03	0.98
15.1	184.1	112.3
48.295		

NOTE.—When dollars and cents are written together, the first two figures on the right hand of the decimal point are *cents*, and the third *mills*; and *all* figures on the right of the third figure, express the *decimal parts* of a mill. Thus, $5.25,5, read, *five dollars, twenty-five cents,* and *five mills*; also, $6.10,7.5, read, *six dollars, ten cents, seven mills* and *five-tenths of a mill.*

APPLICATION.

1. Add together $171.611, $25.5, $1.125, $1525.50, $15.7586? *Ans.* $1739.4946.

2. What is the sum of 4 pieces of cloth measuring 35.5 yards, 31.25yds., 37.75yds. and 29.125yds.? *Ans.* 133.625.

3. Add together 10.5 bushels, 15.25bu., 129,125bu., 0.75 bu., and 9.875bu.? *Ans.* 165.5.

4. What is the sum of twenty-five and *five-tenths,* one hundred and nine and *twenty-five hundredths,* and twelve and *one hundred and twelve thousandths.* *Ans.* 146.862.

SECTION XVII.

SUBTRACTION OF DECIMALS.

ART. 73. RULE.

I. *If the numbers be all decimals, subtract the less from the greater as in the subtraction of whole numbers; and place the decimal point before the difference.*

QUESTIONS.—Art. 72. What is the rule for the addition of decimals? When dollars and cents are written together, what is said?

II. *But if the figures to be subtracted consist of whole numbers and decimals, write the less whole number under the greater, with the decimal points exactly over each other, and then subtract them as in simple subtraction.*

NOTE.—The proof is the same as in simple subtraction. If there are more decimal figures in the *subtrahend*, than in the *minuend*, you must subtract from *ten*. (See Ex. 1.)

EXAMPLES FOR PRACTICE.

1.	2.	3.
$	yds.	bu.
85.75	195.87	987.8
25.87,5	49.75	648.75
59.87,5		

APPLICATION.

1. Henry owed William $0.87,5, and paid $0.75; how much does he owe him yet? *Ans.* $0.12,5

2. I was indebted to my landlord $25 for rent, and paid him $18.75; how much do I still owe him? *Ans.* $6.25.

3. A lady went to market with $5, and spent $1.87,5, how much had she left? *Ans.* $3.12,5.

4. From 1 yard take .5 of a yard? *Ans.* .5yd.

5. From 9.5yds. take 6.25yds.? *Ans.* 3.25yd.

6. Borrowed $324.78, and paid $105.32,6; how much remains? *Ans.* $219.45,4.

7. A man owed a bill of $11.25, and paid $9.31,25; how much remains unpaid? *Ans.* $1.93,75.

8. From .875 take .7? *Ans.* .175

MULTIPLICATION OF DECIMALS

ART. 74. RULE.

Multiply as in whole numbers, and point off as many figures for decimals in the product, as there are decimals in the multiplier and multiplicand.

QUESTIONS.—Art. 73. What is the rule for subtraction of decimals? What is said of proof? If there be more decimal figures in the subtrahend than in the minuend, what must you do?—Art. 74. What is the rule for the multiplication of decimals?

NOTE.—If there be not so many figures in the product as in the multiplicand and multiplier, supply the defect by prefixing ciphers.

EXAMPLES FOR PRACTICE.

1	2.	3.
$	yds.	ft.
5.25	9.87	195.5
2	3	1.25
10.50		

APPLICATION.

1. What is the product of 18.07 multiplied by 5? *Ans.* 90.35.

2. If one yard of muslin cost $0.12,5; what will 25.5yds. cost? *Ans.* $3.18,75.

3. What will be the product of .5 multiplied by .5? *Ans.* .25.

4. Multiply four hundred and four-tenths by 25.125? *Ans.* 10060.05.

5. Bought 28.25 yards of cloth, at $1.25 per yard; what amount will pay for the whole? *Ans.* $35.31,25.

6. Multiply 250.2 feet by 15.5? *Ans.* 3878.10ft

7. What is the product of .95 multiplied by .75? *Ans.* .7125.

8. What will 9yds. calico cost at $0.12,5 per yard? *Ans.* $1.12,5.

9. Multiply 30 by .03; and 5 by .005? *Ans.* .90, .025.

10. What will 125 bushels of potatoes cost at $0.87,5 per bushel? *Ans.* $109.37.5

SECTION XVIII.

DIVISION OF DECIMALS.

ART. 75. RULE.

I. *Divide as in whole numbers, and point off as many decimal figures in the quotient as the number of decimals in the dividend exceeds that of the divisor. Or,*

II. *Take away the decimal point from the divisor, and remove the decimal point in the dividend, as many figures to the right, as there are decimal figures in the divisor; then divide as in whole numbers. But if the number of decimals in the quotient and divisor together is not equal to the number in the dividend, supply the defect by prefixing ciphers to the quotient.*

III. *If there be more decimal figures in the divisor than in the dividend, supply the deficiency by adding ciphers to the dividend.*

Proof.—The proof is the same as in simple division.

Note 1.—If the dividend and divisor are both entirely decimal, or the dividend only, *the answer will be decimal.*

Note 2.—If the decimal figures in the divisor and those of the dividend are equal, and there is no remainder after dividing, *the answer will be whole numbers.*

Note 3.—To divide by 10, 100, 1000, &c., remove the decimal point as many places to the left as there are ciphers in the divisor.

Note 4.—It is not usually necessary, that decimals should be carried to more than from three to six places of figures.

Ex. 1. Let it be required to divide 45 625 by 12.5. *Ans.* 3.65.

OPERATION.

```
12.5)45.625(3.65
     375
     ---
      812
      750
      ---
       625
       625
```

In this example, we divided as in whole numbers, and pointed off two decimal figures in the quotient, because the number of decimals in the dividend exceeds those of the divisor by two.

Ex. 2. Let it be required to divide .175 by 2.5. *Ans.* .07.

OPERATION.

```
2.5).175(.07
     175
     ---
```

In the example, we find that the number of decimals in the quotient and divisor, is not equal to the number in the dividend, therefore we had to supply the defect by prefixing a cipher to the left of the 7.

Questions.—Art. 75. What is the rule for the division of decimals? The proof? What is said in 1st *note?* The 2nd? The 3rd The 4th?

Ex. 3. Let it be required to divide 5.5 by 1.25.

OPERATION.

```
125)5.50(4.4
    500
    ---
     500
     500
```

In this example it will be observed, that the number of decimals in the divisor is greater than those in the dividend, therefore we had to add a cipher to the decimals of the dividend to make the two equal. We then divided as in whole numbers, and found that the dividend contained the divisor 4 times and 50 of a remainder. We then added another cipher to this remainder, and found that the divisor was contained in it exactly four times; we wrote the 4 in the quotient with the decimal point before it.

EXAMPLES FOR PRACTICE.

1. Divide 2.3421 by 2.11. *Ans.* 1.11.
2. Divide 12.82561 by 3.01. *Ans.* 4.261
3. Divide 8.247 by .002. *Ans.* 4123.5.
4. Divide 1.728 by 12. *Ans.* .144.
5. Divide .1728 by 12. *Ans.* .0144.
6. Divide 983 by 6.6. *Ans.* 148.939 +.
7. Divide 45.625 by 12.5. *Ans.* 3.65

8. If $550.755 be divided equally between 15 men, what will be the share of each man? *Ans.* $36.717.

9. If 8 yards cost $16.80, what is the price of one yard? *Ans.* $2.10.

10. Divide 37.5 barrels of flour among 25 men, and tell how much each will receive? *Ans.* 1.5 barrels.

11. Divide $2 between 10 boys, and tell what each will receive? *Ans.* $0.20.

12. If $0.87,5 be divided between 25 persons, what will each receive? *Ans.* $0.03,5.

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SECTION XIX.

REDUCTION OF DECIMALS.

CASE I.

Art. 76. *To reduce a vulgar fraction to a decimal.*

RULE.

Annex ciphers to the NUMERATOR, *and divide by the* DENOMINATOR, *and the quotient will be the decimal required.*

Ex. Let it be required to reduce $\frac{1}{4}$ to a decimal.

OPERATION.

$$4\,)\,\underline{1.00}$$
$$.25$$

After adding a cipher to the numerator, the denominator was contained in it twice, and 2 of a remainder; we add another cipher to this remainder, which makes it 20, and 4 is contained in 20, 5 times. Hence .25 is the answer.

EXAMPLES FOR PRACTICE.

1. Reduce $\frac{3}{4}$ to a decimal? *Ans.* .75
2. Reduce $\frac{7}{8}$ to a decimal? *Ans.* .875.
3. Reduce $\frac{7}{16}$ to a decimal? *Ans.* .4375.
4. Reduce $\frac{1}{2}$ to a decimal? *Ans.* .5
5. Reduce $\frac{2}{3}$, $\frac{5}{6}$, $\frac{1}{8}$, and $\frac{1}{25}$ to decimals? *Ans.* .666+, .833+, .125, .04.
6. Reduce $\frac{1}{4}$, $\frac{3}{4}$, $\frac{1}{8}$, and $\frac{1}{16}$ of a dollar to decimals? *Ans.* \$0.25, \$0.75, \$0.125, \$0.0625

CASE II.

Art. 77. To reduce a compound number to a decimal of a higher denomination.

RULE.

I. *Write the given numbers in a perpendicular column, proceeding from the least to the greatest denomination; and opposite to each dividend, on the left hand, place such a number for a divisor, as will reduce it to the next superior denomination.*

Questions.—Art. 76. What is the rule for reducing a vulgar fraction to a decimal?—Art. 77. What is the rule to reduce a compound number to a decimal of a higher denomination?

II. *Then, beginning with the lowest, divide each denomination, and write the quotient of each division, as decimal parts, on the right hand of the dividend next below it; and so continue, until they are divided; the last quotient will be the decimal required.*

NOTE.—The following rule will be frequently found more convenient:

Reduce the number to its lowest given denomination, and divide it by the number of units that will make a whole number of that denomination to which it is reduced, adding ciphers to the dividend until it will contain the divisor.

Ex. Let it be required to reduce 8s. 6d. to the decimal of a pound, and 21 days to the decimal of a month.

1. OPERATION.

12)6.0

20)8.50

Ans. .425

2. OPERATION.

8s. 6d.
12

1£.=240d.)1020(.425
960

600
480

1200
1200

BY 2d OPERATION.

30)210

.7mo

In the first operation, after writing the denominations in a perpendicular column, we divided the 6d. by 12, the number of pence in one shilling, because shillings are the next higher denomination. But as 6 would not contain 12, we add a cipher to it; then, after dividing by 12 we obtained .5, *five-tenths* of a shilling for the quotient.

We then wrote the 8s. on the left hand of the .5, and divided the whole by 20, the number of shillings in one pound, and obtained .425 of a pound for the answer.

In the second operation, we first reduced the shillings to pence, the lowest denomination given, and divided by 240, the number of pence in one pound. But as the dividend would not contain the divisor, we added a cipher, and continued to add ciphers to the different remainders, until noth-

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QUESTION.—Art. 77. What is the rule given in the *note?*

ing remained. Hence we obtained .425, the same as that obtained by the first operation.

In the second example, we divided 21 by 30, the number of days in a month, when interest is calculated, and obtained, after adding a cipher, .7 for the quotient. Hence 21 days is the *seven-tenths* of a month.

EXAMPLES FOR PRACTICE.

1. Reduce 15s. 6d. to the decimal of a pound. *Ans.* .775£.
2. Reduce 10s. to the decimal of a pound. *Ans.* .5£.
3. Reduce 25cts. to the decimal of a dollar. *Ans.* $.25
4. Reduce 3 quarters to the decimal of a yard. *Ans.* .75yd
5. Reduce 1 quarter to the decimal of a yard. *Ans.* .25yd
6. Reduce 5oz. to the decimal of a pound. *Ans.* .3125lb.
7. Reduce 18lb. to the decimal of a qr. *Ans.* .6428+.
8. Reduce 56lb. to the decimal of a cwt. *Ans.* .5cwt.
9. Reduce 1 quarter to the decimal of a ton. *Ans.* .0125.
10. Reduce 20 days to the decimal of a month. *Ans.* .666mo
11. Reduce 3mo. to the decimal of a year. *Ans.* .25y.
12. Reduce 125 days to the decimal of a year. *Ans.* .3424y.+
13. Reduce 15£. 15s. and 9d. to the decimal of a pound. *Ans.* 15.7875£
14. Reduce 6fur. 8rd. to the decimal of a mile. *Ans.* 775m
15. Reduce 9 inches to the decimal of a foot. *Ans* .75f.
16. Reduce 3 pecks to the decimal of a bushel. *Ans.* .75bu
17. Reduce 1pk. 6qt. 1pt. to the decimal of a peck. *Ans.*
18. Reduce 3oz. troy, to the decimal of a pound. *Ans.*
19. Reduce 3 quarts to the decimal of a gallon. *Ans.*
20. Reduce 45gal. 2qt. 1pt. to the decimal of a hogshead. *Ans.*

CASE III.

Art. 78. To find the value of a decimal in whole numbers of a lower denomination.

RULE.

I. *Multiply the given decimal by the number required of the next lower denomination to make* ONE *of the given denomination, and point off on the* RIGHT *as many figures for decimals, as there were figures in the given decimal.*

II. *Multiply the remaining decimal by the number that will reduce it to the next lower denomination, pointing off for a remainder as before, and thus proceed, until the reduction is carried to the denomination required.*

III. *The several numbers standing at the left hand of the point will be the answer, in whole numbers, of the different lower denominations.*

Ex. What is the value of .425 of a pound? *Ans.* 8s. 6d.

OPERATION.

```
 .425
   20
 ----
8.500
   12
 ----
6.000
 ----
```

8s. 6d. *Ans.*

In this example, we first multiplied by 20, the number of shillings in a pound, and pointed off in the quotient, as many figures for decimals, as there are decimals in the multiplicand. We multiplied the decimals again, and pointed off as before, hence we obtained 8s. 6d. for the answer.

Examples for Practice.

1. Reduce .75 of a pound to its whole number. *Ans.* 15s.
2. What is the value of .628125 of a pound? *Ans.* 12s. 6¾d.
3. What is the value of .625 of a cwt.? *Ans.* 2qr. 14lb.
4. What is the value of .05 of an acre? *Ans.* 8P.
5. What is the value of .86 of a cwt.? *Ans.* 3qr. 12lb. 5oz. 1.92dr.

Question.—Art. 78. What is the rule to find the value of a decimal, &c.

6. What is the value of .75 of a bushel? *Ans.* 3pk.
7. What is the value of £1.88? *Ans.* 1£. 17s. 7d.+
8. What is the value of .8 of a cwt.? *Ans.* 3qr. 5.6lb
9. Reduce .2083hhd. to its value in gallons.
Ans. 13gal. 0qt. .9832pt.
10. Reduce .75 feet to its value in inches. *Ans.* 9in
11. Reduce .775£. to its proper value. *Ans.* 15s. 6d
12. Reduce .5 of a month to its value in days. *Ans.* 15d

SECTION XX.

VULGAR FRACTIONS.

ART. **79**. A VULGAR FRACTION is any part of an integer, or whole number, expressed by two numbers, written one above the other, with a line between them:

Thus, $\left\{ \frac{9}{10} \right.$ *Numerator.* / *Denominator*, read *nine-tenths.* (See Art. 66.)

ART. **80**. There are *six* kinds of vulgar fractions, namely, *Proper*, *Improper*, *Simple*, *Compound*, *Complex* and *Mixed Number*.

A PROPER FRACTION is one whose numerator is *less* than the denominator; as, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{5}{6}$, &c.

An IMPROPER FRACTION is one whose numerator is equal to, or greater, than the denominator; as, $\frac{4}{4}$, $\frac{6}{5}$, $\frac{15}{10}$, &c.

A SIMPLE FRACTION is one that has but one numerator and denominator; as, $\frac{3}{5}$, $\frac{7}{8}$, &c. It may be either proper or improper.

A COMPOUND FRACTION is the fraction of a fraction, connected by the word *of*; as, $\frac{1}{4}$ of $\frac{3}{5}$, or $\frac{4}{5}$ of $\frac{3}{4}$ of $\frac{8}{9}$, &c.

A MIXED NUMBER is a whole number and fraction written together; as $6\frac{1}{4}$, $12\frac{1}{2}$, $18\frac{3}{4}$, &c., read *six and a fourth*, *twelve and a half*, *&c.*

QUESTIONS.—Art. 79. What is a vulgar fraction?—Art. 80. How many kinds of vulgar fractions? What is a proper fraction? Improper fraction? A simple fraction? A compound fraction? A mixed number? A complex fraction? What is the value of a fraction?

A **Complex Fraction** is a fraction having a fraction or mixed number for its numerator or denominator, or for both; as, $\frac{\frac{3}{4}}{\frac{7}{8}}$, $\frac{5}{8\frac{1}{3}}$, &c. This form of the fraction is very seldom used.

Note.—The *value* of a fraction is the quotient arising from the division of the *numerator* by the *denominator*. For example, let it be required to divide an apple between two boys. Here, the 1 is to be divided by 2; but as 2 is not contained in 1, we can only express it by writing the 2 under the 1; or by using the sign of division: thus, $1 \div 2 = \frac{1}{2}$.

SECTION XXI

REDUCTION OF VULGAR FRACTIONS.

Art. 81. The **Reduction of Vulgar Fractions** is changing their *form*, or *terms*, without altering their value.

CASE I.

Art. 82. To reduce a fraction to its lowest terms.

RULE.

I. *Divide the given numerator and denominator by any number greater than* 1, *that will divide them both without a remainder. Or,*

II. *Divide both numerator and denominator by their greatest common divisor, and the result will be the fraction in its lowest terms.*

Note.—For the common divisor, see Art. 60.

Ex. Reduce $\frac{3}{15}$ and $\frac{6}{18}$ to their lowest terms.

OPERATION.

$3)\frac{3}{15} = \frac{1}{5}$ *Ans.*

$3)\frac{6}{18} = \frac{2}{6}$, again

$2)\frac{2}{6} = \frac{1}{3}$ *Ans.*

In the first example, we divide both terms of the fraction by 3, and it is reduced to its lowest terms. In the second example, we divided both terms of the fraction by 3, and the fraction was reduced to $\frac{2}{6}$; this we again divided by 2, and we find the result to be $\frac{1}{3}$, which is the lowest term.

Questions.—Art. 81. What is the reduction of vulgar fractions? Art. 82. What is the rule for the reduction of fractions to their lowest terms? Explain the example?

EXAMPLES FOR PRACTICE.

1.	Reduce $\frac{2}{12}$ to its lowest terms.	*Ans.* $\frac{1}{6}$
2.	Reduce $\frac{6}{30}$ to its lowest terms.	*Ans.* $\frac{1}{5}$
3.	Reduce $\frac{8}{34}$ to its lowest terms.	*Ans.* $\frac{4}{17}$.
4.	Reduce $\frac{12}{96}$ to its lowest terms.	*Ans.* $\frac{1}{8}$.
5.	Reduce $\frac{96}{144}$ to its lowest terms.	*Ans.* $\frac{2}{3}$.
6.	Reduce $\frac{216}{432}$ to its lowest terms.	*Ans.* $\frac{1}{2}$.
7.	Reduce $\frac{346}{618}$ to its lowest terms.	*Ans.* $\frac{173}{309}$.
8.	Reduce $\frac{81}{567}$ to its lowest terms.	*Ans.* $\frac{1}{7}$.
9.	Reduce $\frac{25}{5000}$ to its lowest terms.	*Ans.* $\frac{1}{200}$.
10.	Reduce $\frac{1891}{9116}$ to its lowest terms.	*Ans.* $\frac{1891}{9116}$.

CASE II.

Art. 83. To reduce a mixed number to an improper fraction.

RULE.

Multiply the whole number by the denominator of the fraction, and to the product add the numerator, and place the sum over the denominator of the fraction.

Ex. Let it be required to reduce $6\frac{3}{4}$ to an improper fraction.

OPERATION.

$$\begin{array}{r} 6\frac{3}{4} \\ 4 \\ \hline 24 \\ 3 \\ \hline 27 \\ \hline 4 \end{array}$$

In this example, we multiply the whole number 6, by 4, the denominator of the fraction, and to the product we add the numerator 3, and place the sum 27 over 4, the denominator of the fraction, and we have the true result $\frac{27}{4}$.

EXAMPLES FOR PRACTICE.

1.	In $3\frac{3}{4}$ dollars, how many quarters?	*Ans.* $\frac{15}{4}$.
2.	In $5\frac{1}{16}$ dollars, how many sixteenths?	*Ans.* $\frac{81}{16}$.
3.	Reduce $9\frac{10}{15}$ to an improper fraction.	*Ans.* $\frac{145}{15}$.
4.	Reduce $47\frac{5}{6}$ to its equivalent improper fraction.	*Ans.* $\frac{287}{6}$

Question.—Art. 83: What is the rule for the reduction of a mixed number to an improper fraction?

5. In $9\frac{1}{2}$ feet, how many halves? *Ans.* $\frac{19}{2}$.
6. In $25\frac{1}{4}$ yards, how many quarters? *Ans.* $\frac{101}{4}$.
7. Reduce $19\frac{1}{8}$ to an improper fraction. *Ans.* $\frac{153}{8}$

CASE III.

ART. **84.** *To reduce an improper fraction to a whole, or mixed number.*

RULE.

Divide the numerator by the denominator, and place the remainder, if any, over the denominator at the right hand of the whole number.

Ex. Let it be required to reduce $\frac{15}{4}$ to a mixed number.

OPERATION.

$$\begin{array}{r} 4\,)\,15 \\ \hline 3\frac{3}{4} \end{array}$$

In this example, we divide 15, the numerator, by 4, the denominator, and find it contained in 15, 3 times, and 3 of a remainder. We write this remainder on the right of the whole number, with the 4 under it. Hence the true result is, $3\frac{3}{4}$

NOTE.—This C[illegible] Case II.

EXAMPLES FOR PRACTICE.

1. Reduce $\frac{96}{8}$ to a whole number. *Ans.* 12.
2. Reduce $\frac{3843}{21}$ to a whole number. *Ans.* 183
3. Reduce $\frac{141}{17}$ to its proper terms. *Ans.* $8\frac{5}{17}$.
4. Reduce $\frac{12}{7}$ to its proper terms. *Ans.* $1\frac{5}{7}$.
5. How many dollars in $\frac{37}{16}$ dollars? *Ans.* $2\frac{5}{16}$
6. How many yards in $\frac{101}{4}$ yards? *Ans.* $25\frac{1}{4}$

CASE IV.

ART. **85.** *To reduce a compound fraction to a simple fraction.*

RULE.

Multiply all the numerators together for a new numerator, and all the denominators together for a new denominator, and then reduce the fraction to its lowest terms.

QUESTIONS.—Art. 84. What is the rule for the reduction of an improper fraction to a whole, or mixed number? Art. 85.—What is the rule for the reduction of a compound fraction to a simple one?

Note.—If there be factors in the numerators similar to those in the denominators, they may be cancelled in the operation.

Ex. Let it be required to reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ to a simple fraction.

OPERATION.

$$\frac{2\times3\times4}{3\times4\times5}=\frac{24}{60}.$$

$$12)\tfrac{24}{60}=\tfrac{2}{5}$$

In this example, the product of all the numerators multiplied together, is 24, and that of the denominators, 60; hence, $\frac{24}{60}$ is the simple fraction sought. This, however, may be reduced to lower terms by dividing by 12. The operation may be much shortened by cancelling the similar terms. By inspecting the example, it will be seen that the figures 3 and 4 occur in both the numerator and denominator of the compound fraction; now by *cancelling*, or *striking out* the *threes* and the *fours*, we find that nothing remains but $\frac{2}{5}$, the fraction sought.

Examples for Practice.

1. Reduce $\frac{2}{3}$ of $\frac{4}{5}$ of $\frac{5}{7}$ of $\frac{6}{8}$ of $\frac{7}{11}$ to a sim[illegible]ction. *Ans.* $\frac{2}{11}$.
2. Reduce $\frac{2}{3}$ of $\frac{4}{5}$ of $\frac{6}{7}$ to a simple f[illegible] *Ans.* $\frac{16}{35}$.
3. Reduce $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{9}{10}$ to a simpl[illegible] *Ans.* $\frac{135}{240}$.
4. Reduce $\frac{12}{14}$ of $\frac{5}{6}$ of $\frac{1}{2}$ to a simple [illegible] *Ans.* $\frac{60}{168}=\frac{5}{14}$.
5. Reduce $\frac{4}{5}$ of $\frac{5}{8}$ of $\frac{7}{9}$ to a simple fracti[illegible] *Ans.* $\frac{140}{360}=\frac{7}{18}$.
6. Reduce $\frac{8}{11}$ of $\frac{24}{35}$ of $\frac{15}{24}$ of $9\frac{5}{8}$ to a simple fraction. *Ans.* 3.

CASE V.

Art. **86.** To reduce [illegible] fraction of one denomination to the fraction of another, retaining the same value, but of a higher denomination.

RULE.

Multiply the denominator of the given fraction by all the denominations between it and that to which it is to be reduced, for a new denominator, and place it under the numerator of the given fraction; which reduce to its lowest terms.

Ex. Let it be required to reduce $\frac{5}{6}$ of a penny to the fraction of a pound.

Questions.—Art. 86. What is the rule for the reduction of fractions, &c.? Explain the example?

OPERATION.

$6 \times 20 \times 12 = \frac{5}{1440} = \frac{1}{288}$

In this example it is observed, that we multiplied 6, the denominator of the given fraction, by 20 and by 12, the denominations between it and that to which it is to be reduced; and placed the product under the numerator of the given fraction, and then reduced it to its lowest terms.

EXAMPLES FOR PRACTICE.

1. Reduce $\frac{1}{2}$ of a farthing to the fraction of a shilling. *Ans.* $\frac{1}{96}$.
2. Reduce $\frac{4}{5}$ of a penny to the fraction of a pound. *Ans.* $\frac{1}{300}$.
3. Reduce $\frac{4}{5}$ of a cent to the fraction of a dollar. *Ans.* $\frac{1}{125}$.
4. Reduce $\frac{2}{3}$ of a quarter to the fraction of a cwt. *Ans.* $\frac{1}{6}$.
5. Reduce $\frac{3}{4}$ of a quart to the fraction of a hhd. *Ans.* $\frac{1}{336}$.
6. Reduce $\frac{10}{11}$ of a minute to the fraction of a day. *Ans.* $\frac{1}{1584}$
7. Reduce $\frac{3}{4}$ of a foot to the fraction of a yard. *Ans.* $\frac{1}{4}$.
8. Reduce $\frac{2}{3}$ of an inch to the fraction of a yard. *Ans.* $\frac{1}{54}$.

CASE VI.

ART. 87. T[illegible]he fraction of one denomination to the fraction o[illegible]aining the same value, but of a less denominati[illegible]

RULE.

Multiply the nume[illegible]or of the given fraction by all the denominations between it and that to which it is to be reduced, for a new numerator, and place it ove[illegible]e given denominator. Reduce the new fraction to its lowest [illegible]erms.

Ex. Let it be required to reduce $\frac{1}{96}$ of a shilling to the fraction of a farthing.

OPERATION.

$\frac{1 \times 12 \times 4}{96} = \frac{48}{96}$

$48)\frac{48}{96} = \frac{1}{2}$ qr.

In this example, we multiply the numerator of the given fraction by 12 and 4, units of the denominations between it and that to which it is to be reduced, and place the sum of the products, 48, over the denominator of the fraction, and then reduce it to its lowest terms.

QUESTION.—Art. 87. What is the rule for the reduction of fractions, &c.?

EXAMPLES FOR PRACTICE.

1. Reduce $\frac{4}{1200}$ of a pound to the fraction of a penny. *Ans.* $\frac{4}{5}$d
2. Reduce $\frac{1}{180}$ of a dollar to the fraction of a mill. *Ans.* $5\frac{5}{9}$
3. Reduce $\frac{1}{4}$ of a yard to the fraction of a foot. *Ans.* $\frac{3}{4}$ft
4. Reduce $\frac{1}{6}$ of a cwt. to the fraction of a quarter *Ans.* $\frac{2}{3}$qr
5. Reduce $\frac{1}{336}$ of a hhd. to the fraction of a quart. *Ans.* $\frac{3}{4}$qt
6. Reduce $\frac{2}{27}$ of a lb. troy to the fraction of an ounce. *Ans.* $\frac{8}{9}$oz

CASE VII.

ART. 88. *To reduce a denominate fraction to its proper value in whole numbers.*

RULE.

Multiply the numerator of the given fr[illegible] by so many units as will make one of the denominati[illegible]ch it is to be reduced, and divide the product by th[illegible]tor of the given fraction.

Ex. Let it be required to reduce $\frac{2}{3}$ of a pound to its proper value.

OPERATION.

$$\frac{2}{3}\times 20\text{s.}=\frac{40\text{s.}}{3}=13\text{s. }4\text{d.}$$

We multiply the numerator of the given fraction by 20, the number of shillings in one pound, and divide the product 40 by 3, the denominator of the given fraction. The 3 is containe in 40s. 13 times, and 1 shilling of a remainder. This mainder must be reduced to pence, and then divided b which gives 4d. for the quotient

EXAMPLES FOR PRACTICE.

1. What is the value of $\frac{3}{10}$ of a day? *Ans.* 7
2. Reduce $\frac{4}{7}$ of 12.28 dollars to its value. *Ans.*

3. Reduce $\frac{7}{8}$ of a yard of cloth to its proper value. *Ans.* 3qr. 2n

4. Reduce $\frac{5}{9}$ of a lb. avoirdupois to its proper value. *Ans.* 8oz. 14$\frac{2}{9}$dr.

5. What is the value of $\frac{5}{19}$ of an acre? *Ans.* 1R. 2$\frac{2}{19}$pr.

6. What is the value of $\frac{5}{8}$ of a bushel? *Ans.* 2pk. 4qt.

7. What is the value of $\frac{2}{3}$ of a hhd. of wine? *Ans.* 42gal.

8. What is the value of $\frac{5}{9}$ of 75.25 dollars? *Ans.* $41.80,5

9 Reduce $\frac{11}{14}$ of 20 cwt. 1qr. to its proper value.

10. What is the value of $\frac{12}{16}$ of a lb. troy? *Ans.* 9oz.

CASE VIII.

REDUCTION OF COMPLEX FRACTIONS.

Art. 89. 1st. To reduce a complex fraction, when the numerator or denominator has a fraction annexed.

RULE.

Multiply both the numerator and denominator of the principal fraction, by the DENOMINATOR *of the annexed fraction, and add the* NUMERATOR *to that term to which it belongs, and the result will be a simple fraction.*

Ex. Let it be required to reduce $\frac{11\frac{3}{4}}{14}$ to a simple fraction

OPERATION.

$$\begin{array}{ll} 11\times4+3 & =47 \\ 14\times4 & =\overline{56} \end{array}$$

Here, we multiply the numerator of the principal fraction by 4, the denominator of the annexed fraction, and added 3, the numerator to the product. We then multiplied the denominator of the principal fraction again by 4, and we have $\frac{47}{56}$ for the simple fraction.

EXAMPLES FOR PRACTICE,

1. Reduce $\frac{42\frac{7}{8}}{49}$ to a simple fraction. *Ans.* $\frac{343}{392}=\frac{7}{8}$.

QUESTIONS.—Art. 89. What is the rule for reduction of complex fractions? Explain the example.

2. Reduce $\frac{73}{131\frac{2}{5}}$ to a simple fraction. *Ans.* $\frac{365}{657}$ — $\frac{5}{9}$

3. Reduce $\frac{34\frac{1}{2}}{46}$ to a simple fraction. *Ans.* $\frac{3}{4}$

4. Reduce $\frac{7}{19\frac{3}{4}}$ to a simple fraction. *Ans.* $\frac{28}{79}$

5. Reduce $\frac{19\frac{5}{8}}{20}$ to a simple fraction. *Ans.* $\frac{157}{160}$

6. Reduce $\frac{1\frac{3}{7}}{14}$ to a simple fraction. *Ans.* $\frac{10}{98}$

ART. **90.** 2nd. To reduce a complex fraction, when both numerator and denominator are fractions.

RULE.

Multiply the numerator of each fraction by the denominators of the other, and it will be reduced to a simple fraction.

Ex. Let it be required to reduce $\frac{\frac{1}{4}}{\frac{3}{8}}$ to a simple fraction.

OPERATION.

$$\begin{array}{l} 1 \times 8 = 8 \\ 4 \times 3 = \overline{12} \end{array}$$

In this example, it will be seen, that we multiply 1, the numerator of the fraction above the line by 8, the denominator of the fraction below the line; and again we multiply 4, the denominator of the fraction above the line by 3, the numerator of the fraction under the line, and we have the fraction reduced to $\frac{8}{12}$, which may be again reduced to $\frac{2}{3}$ by dividing both terms by 4.

NOTE.—It must be observed, that the product of the *numerator* of the fraction above the line, by the denominator of the fraction under the line, will be the numerator of the new fraction, and that the product of the denominator of the fraction above the line by the numerator of the one below the line, will be the denominator of the new fraction.

EXAMPLES FOR PRACTICE.

1. Reduce $\frac{\frac{3}{7}}{\frac{3}{8}}$ to a simple fraction. *Ans.* $1\frac{1}{7}$.

2. Reduce $\frac{\frac{1}{5}}{\frac{3}{8}}$ to a simple fraction. *Ans.* $\frac{8}{15}$

QUESTION.—Art. 90. What is the rule, &c.

3. Reduce $\frac{\frac{3}{17}}{\frac{9}{10}}$ to a simple fraction. *Ans.* $\frac{30}{153}$

4. Reduce $\frac{\frac{1}{3}}{\frac{3}{7}}$ to a simple fraction. *Ans.* $\frac{7}{9}$

5. Reduce $\frac{\frac{7}{12}}{\frac{5}{8}}$ to a simple fraction. *Ans.* $\frac{14}{15}$.

Art. 91. 3rd. To reduce a complex fraction, when the numerator or denominator is a fraction, and the other term a whole number.

RULE.

Multiply the whole number by the denominator of the fraction, and the product will be the numerator of the new fraction, if the whole number be ABOVE *the fractional term, and the denominator when* BELOW *the fractional term.*

Ex. Let it be required to reduce $\frac{12}{\frac{3}{7}}$ to a simple fraction.

OPERATION.

$$12 \times 7 = \frac{84}{3} = 28$$

We multiply 12, the numerator of the fractional expression by 7, the denominator of the fraction under the line, and write 3 the numerator of the fractional term under the product. Hence $\frac{84}{3}$ is the simple fraction, which may be reduced to 28.

Examples for Practice.

1. Reduce $\frac{\frac{3}{7}}{14}$ to a simple fraction. *Ans.* $\frac{3}{98}$

2. Reduce $\frac{5}{\frac{1}{4}}$ to a simple fraction. *Ans.* 20

3. Reduce $\frac{18}{\frac{3}{8}}$ to a simple fraction. *Ans.* 48

4. Reduce $\frac{\frac{9}{10}}{25}$ to a simple fraction. *Ans.* $\frac{9}{250}$

Question.—Art. 91. What is the rule for reducing a complex fraction, when, &c.

5. Reduce $\frac{\frac{3}{4}}{21}$ to a simple fraction. *Ans.* $\frac{3}{84}$

6 Reduce $\frac{\frac{3}{7}}{5}$ of $8\frac{1}{2}$ to a simple fraction.

Note.—If the complex fraction consists of a mixed number for one term of the fraction, and a whole number for the other, or if there be mixed numbers in both terms, reduce the mixed numbers to improper fractions, by *rule* under Case II. and then work by the above rule.

Ex. 1. Reduce $\frac{4\frac{7}{8}}{9}$ to a simple fraction

OPERATION.

$$4 \times 8 + 7 = \frac{\frac{39}{8}}{9} = \frac{13}{24} \text{ Ans.}$$

2. Reduce $\frac{6}{8\frac{1}{3}}$ to a simple fraction. *Ans.* $\frac{18}{25}$

3. Reduce $\frac{8}{9\frac{3}{10}}$ to a simple fraction. *Ans.* $\frac{80}{93}$

4. Reduce $\frac{9\frac{3}{5}}{12\frac{1}{2}}$ to a simple fraction. *Ans.* $\frac{96}{125}$

5. Reduce $\frac{5\frac{1}{2}}{7\frac{1}{4}}$ to a simple fraction.

CASE IX.

Art. 92. *To reduce several fractions to others of the same value, having a common denominator.*

Note.—Fractions have a common denominator, when all their denominators are alike.

RULE.

Multiply each numerator into all the denominators, except its own for a new numerator; all the denominators into each other for a common denominator.

Ex. Let it be required to reduce $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$ to a common denominator.

Question.—If the complex fraction consists, &c. what must be done?

OPERATION.

$2\times4\times5=40$ the new numerator for $\frac{2}{3}=\frac{40}{60}$.
$3\times3\times5=45$ " " " $\frac{3}{4}=\frac{45}{60}$.
$4\times3\times4=48$ " " " $\frac{4}{5}=\frac{48}{60}$.

$3\times4\times5=60$ common denominator.

It will be observed that we multiplied 2, the numerator of the first fraction, by 4, and that product again by 5, the denominators of the other two fractions, omitting its own denominator. We proceed in like manner to multiply the numerators of the other fractions by all the denominators, except their own, for new numerators; and lastly we multiplied all the denominators into each other for a common denominator, which we placed under each of the new numerators.

NOTE.—The fractions should be reduced to their lowest terms, before the operation, or it may be done after they are brought to a common denominator.

EXAMPLES FOR PRACTICE.

1. Reduce $\frac{3}{4}$ and $\frac{5}{6}$ to a common denominator. *Ans.* $\frac{18}{24}$, $\frac{20}{24}$.
2. Reduce $\frac{6}{9}$, $\frac{2}{7}$, $\frac{1}{3}$, $\frac{7}{8}$ to a common denominator. *Ans.* $\frac{336}{504}$, $\frac{144}{504}$, $\frac{168}{504}$, $\frac{441}{504}$.
3. Reduce $\frac{4}{7}$, $\frac{3}{8}$ and $\frac{5}{11}$ to a common denominator. *Ans.* $\frac{352}{616}$, $\frac{231}{616}$, $\frac{280}{616}$.
4. Reduce $\frac{1}{6}$, $\frac{2}{5}$, $\frac{7}{8}$ and $\frac{1}{4}$ to a common denominator. *Ans.* $\frac{160}{960}$, $\frac{384}{960}$, $\frac{840}{960}$, $\frac{240}{960}$.
5. Reduce $\frac{5}{11}$ and $\frac{5}{9}$ to a common denominator. *Ans.* $\frac{45}{99}$, $\frac{55}{99}$.
6. Reduce $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$ and $\frac{4}{5}$ to a common denominator. *Ans.* $\frac{60}{120}$, $\frac{80}{120}$, $\frac{90}{120}$, $\frac{96}{120}$.
7. Reduce $\frac{3}{5}$ and $\frac{3}{8}$ to a common denominator. *Ans.* $\frac{24}{40}$, $\frac{15}{40}$.
8. Reduce $\frac{1}{3}$, $\frac{4}{11}$, $\frac{5}{8}$, $\frac{5}{6}$ and $\frac{1}{7}$ to a common denominator. *Ans.*
9 Reduce $7\frac{3}{4}$, $5\frac{6}{11}$ to a common denominator.
10. Reduce $\frac{3}{4}$ of 10 and $\frac{1}{4}$ of 9 to a common denominator.

QUESTIONS.—Art. 92. What is the rule for reducing fractions to a common denominator? Explain the example.

SECTION XXII.

ADDITION OF VULGAR FRACTIONS.

Art. 93. The Addition of Vulgar Fractions is the process of finding the value of two or more fractions in one sum.

RULE.

Reduce the fractions, if necessary, to a common denominator, then add together the numerators, and place their sum over the common denominator.

Note.—In adding mixed numbers and fractions, the whole numbers should be added first, and then the fractions; and if there be any whole numbers in the sum of the fractions, they should be carried to the whole numbers.

If the fractions to be added be compound, they must be reduced to simple fractions, before performing the addition.

Ex. Let it be required to add $\frac{1}{2}$ and $\frac{6}{7}$.

OPERATION.

$1\times7=\ 7$ the new numerator for $\frac{1}{2}=\frac{7}{14}$ $\quad 7+12=19$

$6\times2=12$ " " $\frac{6}{7}=\frac{12}{14}$ $\qquad \frac{19}{12}=1\frac{7}{12}$.

$2\times7=14$ common denominator.

In this example, we first brought the fractions to a common denominator, and then added together 7 and 12, the two new numerators, and placed their sum over the common denominator, which gave $\frac{19}{12}$, this we reduced to $1\frac{7}{12}$.

Examples for Practice.

1. Add together $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{2}{8}$ and $\frac{4}{16}$.	*Ans.* 2
2. Add together $\frac{5}{8}$ and $\frac{3}{5}$.	*Ans.* $1\frac{9}{40}$
3. Add together $\frac{7}{10}$, $\frac{11}{12}$ and $\frac{4}{9}$.	*Ans.* $2\frac{11}{180}$
4. Add together $\frac{1}{7}$, $\frac{2}{7}$, $\frac{4}{7}$, $\frac{5}{7}$ and $\frac{6}{7}$.	*Ans.* $2\frac{4}{7}$.
5. Add together $\frac{4}{9}$, $\frac{8}{21}$ $\frac{11}{24}$ and $\frac{1}{2}$.	*Ans.* $1\frac{7110}{9072}$.
6. Add 19, 7, $\frac{1}{2}$ and $\frac{2}{5}$ together.	*Ans.* $26\frac{9}{10}$
7. Add $\frac{1}{2}$ of $\frac{7}{8}$ and $\frac{2}{3}$ of $\frac{19}{20}$ together.	*Ans.* $1\frac{17}{240}$

Questions.—Art. 93. What is the addition of vulgar fractions? What is the rule? In the *note*, what is said? If the fraction to be added be compound, what must be done?

8. Add together ⅛ and $\frac{1}{16}$ of a dollar. *Ans.* 18¾cts.

9. What is the sum of \$0.12½, \$0.18¾, \$0.31¼, \$0.06¼, and \$0.31¼? *Ans.* \$1.

10. Add ⅔ of ¾ to ½ of ⅔ of ¾. *Ans.* ¾.

11. What is the sum of ⅗ of a yard and ½ of a foot? *Ans.* 2ft. 3⅗in.

12. Add $\frac{4}{7}$ of a ton to $\frac{9}{10}$ of a cwt. *Ans.* 12cwt. 1qr. 8lb. 12oz. 12⅘dr.

13. Add together 5¼lb. 3⅙lb. 9¾lb. 8⅞lb. and 4½lb. *Ans.* 31lb. 8oz. 10⅔dr.

14. Add ¾ of 10, ⅘ of 12, and ⅚ of 20, together. *Ans.* 33$\frac{23}{30}$.

15. Add together ⅓ of a day and ½ of an hour. *Ans.* 8h. 30m

16. A man owns ⅜ of a farm, valued at \$3600, and buys the share of another, which is $\frac{5}{16}$; what part does he now possess, and what is it worth? *Ans.* $\frac{11}{16}$, worth \$2,475

SECTION XXIII.

SUBTRACTION OF VULGAR FRACTIONS.

ART. **94.** The SUBTRACTION OF VULGAR FRACTIONS is the process of finding the difference between two fractions.

RULE.

Bring the fractions, if necessary, to a common denominator, then subtract the less numerator from the greater, and place the difference over the common denominator.

Ex. Let it be required to subtract ¼ from ⅗.

OPERATION.

$$\frac{3}{5}-\frac{1}{4}=\frac{12}{20}-\frac{5}{20}=\frac{7}{20}$$

In this example, we first reduced the fractions to a common denominator, and then subtracted the numerators, and placed 7, the difference, over 20, the common denominator.

NOTE.—The answer should be reduced to its lowest terms.

QUESTIONS.—Art. 94. What is the subtraction of vulgar fractions What is the rule? To what should the answer be reduced?

EXAMPLES FOR PRACTICE.

1. From $\frac{7}{11}$ take $\frac{2}{11}$.	*Ans.* $\frac{5}{11}$
2. From $\frac{1}{2}$ take $\frac{1}{4}$.	*Ans.* $\frac{1}{4}$.
3. From $\frac{7}{8}$ take $\frac{6}{8}$.	*Ans.* $\frac{1}{8}$
4. From $\frac{7}{18}$ take $\frac{4}{21}$.	*Ans.* $\frac{25}{126}$.
5. From $\frac{11}{15}$ take $\frac{3}{7}$.	*Ans.*
6. From $\frac{2}{3}$ of $\frac{9}{11}$ take $\frac{1}{4}$ of $\frac{2}{7}$.	*Ans.* $\frac{73}{154}$
7. From $\frac{1}{2}$ of a pound take $\frac{3}{4}$ of a shilling.	*Ans.* 9s. 3d
8. From $\frac{1}{2}$ of a shilling take $\frac{3}{4}$ of a penny.	*Ans.* $5\frac{1}{4}$d
9. From $\frac{3}{4}$ of a dollar take $\frac{1}{2}$.	*Ans.* $\frac{1}{4}$.
10. From $\frac{3}{8}$ of $12\frac{5}{6}$, take $\frac{2}{5}$ of $9\frac{7}{12}$.	*Ans.* $\frac{47}{48}$.

ART. **95.** To subtract a proper fraction or a mixed number from a whole number.

RULE.

Subtract the numerator of the fraction from a whole number and write the remainder over the denominator of the fraction, and carry 1, *as in the subtraction of whole numbers.*

NOTE.—If both *subtrahend* and *minuend* be mixed numbers, reduce them to improper fractions, and then subtract them by the *rule* under Art. 94.

Ex. From 12 take $2\frac{1}{2}$, and from $5\frac{1}{4}$ take $2\frac{1}{2}$.

1. OPERATION.

$$\begin{array}{r} 12 \\ 2\frac{1}{2} \\ \hline 9\frac{1}{2} \end{array}$$

2. OPERATION.

$$\begin{array}{cc} 5\frac{1}{4} - & 2\frac{1}{2} \\ 4 & 2 \\ \hline \end{array}$$

$$\frac{21}{4}-\frac{5}{2}=\frac{42}{8}-\frac{20}{8}=\frac{22}{8}=2\frac{3}{4}$$

Since we have no fraction from which to take the $\frac{1}{2}$, we take it from 1; hence a half taken from a whole 1, leaves $\frac{1}{2}$. We write this remainder under the fraction of the subtrahend, and carry 1 to the 2, and say 3 from 12, and 9 remains. Hence $9\frac{1}{2}$ is the difference.

In the second example, we first reduced the mixed number to an improper fraction, then to a common denominator, and lastly subtracted the numerators. The result, when reduced, is $2\frac{3}{4}$.

QUESTIONS.—Art. 95. What is the rule for subtracting a proper fraction, &c.? What is said in the *note?*

EXAMPLES FOR PRACTICE.

1. From \$86 take $\$68\frac{7}{16}$. *Ans.* $17\frac{9}{16}$.
2. From 12 take $5\frac{3}{4}$. *Ans.* $6\frac{1}{4}$.
3. From 13 take $9\frac{1}{11}$. *Ans.* $3\frac{10}{11}$.
4. From 23 take $13\frac{1}{3}$. *Ans.* $9\frac{2}{3}$.
5. From 9 yards take $\frac{1}{4}$ of a yard. *Ans.* $8\frac{3}{4}$yd.
6. From 3 feet take $\frac{3}{4}$ of a foot. *Ans.* $2\frac{1}{4}$ft.
7. From 139 take $75\frac{1}{15}$. *Ans.* $63\frac{14}{15}$.
8. From $9\frac{7}{8}$ take $5\frac{11}{12}$. *Ans.* $3\frac{23}{24}$.
9. From 63 gallons take $12\frac{3}{8}$ gallons. *Ans.* $50\frac{5}{8}$.
10. From $53\frac{2}{5}$ take $35\frac{3}{5}$. *Ans.* $17\frac{4}{5}$.
11. From 1cwt. take $\frac{7}{13}$ of a pound. *Ans.* $111\frac{6}{13}$lb.
12. A man owned $\frac{5}{8}$ of a ship, valued at \$2160, and sold $\frac{2}{3}$ of his share; what part has he left, and what is it worth?
Ans. $\frac{5}{24}$, worth \$450.
13. From $\frac{9}{10}$ of 109lb. take $\frac{7}{8}$ of 58lb. *Ans.* $47\frac{7}{20}$.
14. From 7 weeks take $9\frac{7}{10}$ days. *Ans.* $39\frac{3}{10}$ days.
15. From 4 days, $7\frac{1}{2}$ hours, take 1 day, $9\frac{3}{8}$ hours.
Ans. 2d. $22\frac{1}{8}$h.

SECTION XXIV.

MULTIPLICATION OF VULGAR FRACTIONS.

ART. **96.** The MULTIPLICATION OF FRACTIONS is the process of multiplying fractions together, or whole numbers and fractions into each other.

CASE I.

To multiply a fraction by a fraction.

RULE.

Multiply the numerators together for a new numerator, and the denominators together for a new denominator; and then reduce the fraction to its lowest terms.

NOTE.—To multiply a mixed number by a mixed number, reduce them to improper fractions, then work by the preceding rule.

QUESTIONS.–Art. 96. What is the multiplication of fractions? What is the rule?

Ex. Let it be required to multiply $\frac{3}{4}$ by $\frac{2}{3}$, and $4\frac{1}{2}$ by $3\frac{4}{5}$.

1.

OPERATION.

$$\frac{3 \times 2}{4 \times 3} = \frac{6}{12} = \frac{1}{2}$$

2.

OPERATION.

$$\begin{array}{cc} 4\frac{1}{2} & 3\frac{4}{5} \\ 2 & 5 \\ \hline \end{array}$$

$$\frac{9 \times 19}{2 \times 5} = \frac{171}{10} = 17\frac{1}{10}$$

In the first example, we multiplied the numerators, and denominators together, which gave $\frac{6}{12}$ for the new fraction. This we reduced to $\frac{1}{2}$.

In the second example, we first reduced the mixed numbers to improper fractions, and then multiplied as before, and reduced the product to its lowest terms.

EXAMPLES FOR PRACTICE.

1. Multiply $\frac{4}{5}$ by $\frac{2}{3}$. *Ans.* $\frac{8}{15}$.
2. Multiply $\frac{1}{4}$ by $\frac{7}{9}$. *Ans.* $\frac{7}{36}$.
3. Multiply $7\frac{1}{4}$ by $8\frac{1}{2}$. *Ans.* $61\frac{5}{8}$.
4. Multiply $4\frac{1}{2}$ by $\frac{1}{8}$. *Ans.* $\frac{9}{16}$.
5. Multiply $\frac{1}{9}$ by $\frac{8}{17}$. *Ans.* $\frac{8}{153}$.
6. Multiply $\frac{2}{3}$ of 6 by $\frac{3}{4}$ of 25. *Ans.* 75.
7. If a man walk $\frac{8}{11}$ of a mile in an hour, how far would he walk in $\frac{11}{32}$ of an hour? *Ans.* $\frac{1}{4}$ of a mile.
8. What is the cost of $\frac{3}{8}$ of a yard of cloth, at $87\frac{1}{2}$ cts. per yard? *Ans.* $32\frac{13}{16}$.
9. If $\frac{3}{4}$ of $\frac{1}{4}$ of $\frac{2}{5}$ of a dollar will buy a bushel of salt, what will $\frac{1}{5}$ of $\frac{3}{8}$ cost? *Ans.* $\frac{9}{1600}$ cts.
10. Multiply $7\frac{1}{2}$ by $5\frac{3}{5}$. *Ans.* 42.
11. Multiply $6\frac{3}{8}$ by $3\frac{1}{3}$. *Ans.* $21\frac{1}{4}$.
12. What will $7\frac{3}{8}$ yds. cost, at \$$2\frac{3}{4}$ per yard? *Ans.* \$$20\frac{9}{32}$
13. What is the cost of $9\frac{1}{4}$ gallons of molasses, at $31\frac{1}{4}$ cts per gallon? *Ans.* \$$2.89\frac{1}{16}$
14. What will $15\frac{3}{4}$ tons of coal cost at \$$5\frac{1}{16}$ per ton? *Ans.* $79\frac{47}{64}$

CASE II.

ART. 97. To multiply a whole number by a fraction.

RULE.

Multiply the whole number by the numerator of the fraction and divide the product by the denominator.

Note.—To multiply a whole or mixed number by a mixed number, *reduce the mixed number or numbers to an improper fraction, and then work by the above rule.*

Ex. Let it be required to multiply 10 by $\frac{3}{5}$, and 5 by $2\frac{2}{5}$.

1.	2.
OPERATION.	OPERATION.
10	$2 \times 5 + 2 = \frac{12}{5}$ imp. fract
3	
$30 \div 5 = 6$	$5 \times 12 = 60 \div 5 = 12.$

In this first example, we multiplied the whole number 10 by 3 the numerator of the fraction, and divided the product by 5, the denominator.

In the second example, we reduced the mixed number to an improper fraction, and then proceeded as before.

Examples for Practice.

1. Multiply 15 by $\frac{3}{5}$. *Ans.* 9.
2. Multiply 13 by $\frac{4}{7}$. *Ans.* $7\frac{3}{7}$.
3. Multiply 12 by $\frac{2}{7}$. *Ans.* $3\frac{3}{7}$.
4. Multiply $8\frac{3}{5}$ by 8. *Ans.* $68\frac{4}{5}$.
5. Multiply $12\frac{3}{5}$ by $7\frac{3}{5}$. *Ans* $96\frac{3}{5}$.
6. Multiply $4\frac{1}{2}$ by $3\frac{1}{4}$. *Ans.* $14\frac{5}{8}$.
7. Multiply 18 by $\frac{2}{7}$. *Ans.* $5\frac{1}{7}$.
8. What will $23\frac{7}{8}$ pounds of sugar cost at 8 cents per pound? *Ans.* $1.91.
9. What will $8\frac{5}{8}$ yards of cloth cost, at $4 per yard? *Ans.* $34.50.
10. If one ton of iron cost $75, what will $15\frac{11}{15}$ tons cost? *Ans.* $1,180
11. What will $25\frac{5}{8}$ lb. of coffee cost, at $12\frac{1}{2}$ per lb. *Ans.* 3.20\frac{5}{8}$

Questions.—Art. 97. What is the rule for multiplying a whole number by a fraction? How do you multiply a whole, or mixed number by a mixed number?

12. What will 15 gallons of molasses cost, at $31\frac{1}{4}$cts. per gallon? *Ans.* \$4.68$\frac{3}{4}$

13. What will 5 tons of hay cost, at \$14$\frac{3}{4}$ per ton? *Ans.* \$73 75.

14. What will 19 dozen of eggs cost, at $18\frac{3}{4}$cts. per dozen? *Ans.* \$3.56$\frac{1}{4}$.

15. What will $9\frac{1}{8}$ bushels of corn cost, at $62\frac{1}{2}$ cents per bushel? *Ans.* \$5.70$\frac{5}{16}$.

16. If a man can travel $3\frac{4}{9}$ of a mile in an hour, how far can he travel in $9\frac{7}{8}$ hours? *Ans.* $34\frac{1}{72}$.

17. What will $240\frac{3}{11}$ acres of land cost, at \$25$\frac{5}{8}$ per acre? *Ans.* \$6,156$\frac{87}{88}$

18. What will $1\frac{7}{8}$yds. cost, at \$5$\frac{3}{4}$ per yard? *Ans.* \$10$\frac{25}{32}$.

19. What will be the product of $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{7}{8}$ multiplied by 11? *Ans.* $3\frac{5}{24}$.

20. What will be the product of $12\frac{3}{5}$ multiplied by $\frac{1}{3}$ of 7? *Ans.* $29\frac{2}{5}$.

SECTION XXV.

DIVISION OF VULGAR FRACTIONS.

Art. 98. Division of Vulgar Fractions is the process of dividing one fraction by another, or whole numbers and fractions by each other.

CASE I.

To divide a fraction by a fraction.

RULE.

Invert the terms of the divisor, and then proceed as in the multiplication of fractions.

Note.—To divide a mixed number by a mixed number: *reduce them both to improper fractions, and proceed as in the foregoing rule.*

Questions.—Art. 98. What is the division of vulgar fractions? What is the rule to divide a fraction by a fraction?

Ex. Let it be required to divide $\frac{7}{8}$ by $\frac{1}{4}$, and $3\frac{1}{2}$ by $7\frac{1}{2}$.

1.

OPERATION.

$$\frac{7}{8}\div\frac{1}{4}=\frac{7}{8}\times\frac{4}{1}=\frac{28}{8}=3\tfrac{1}{2}$$

2.

OPERATION.

$$\left.\begin{array}{l}3\times2+1=\dfrac{7}{2}\\[2ex]7\times2+1=\dfrac{15}{2}\end{array}\right\}\frac{7}{2}\div\frac{2}{15}=\frac{14}{30}=\frac{7}{15}$$

It will be seen in the first example, that we inverted the terms of the divisor, that is, we put the denominator in the place of the numerator, and the numerator in the place of the denominator, and multiplied them as directed by the rule, and then reduced the result to a mixed number. In the second example, we first reduced the mixed numbers to improper fractions, according to the rule given under Art. 83, and then proceeded according to the rule for the division of fractions.

EXAMPLES FOR PRACTICE.

1. Divide $\frac{8}{9}$ by $\frac{3}{4}$. *Ans.* $\frac{32}{27}$.
2. Livide $\frac{5}{8}$ by $\frac{3}{4}$. *Ans.* $\frac{5}{6}$.
3. Divide $\frac{3}{7}$ by $\frac{2}{3}$. *Ans.* $\frac{9}{14}$.
4. Divide $\frac{10}{11}$ by $\frac{3}{7}$. *Ans.* $\frac{70}{33}$
5. Divide $\frac{5}{13}$ by $\frac{3}{5}$. *Ans.* $\frac{25}{39}$
6. Divide $3\frac{2}{3}$ by $2\frac{1}{4}$. *Ans.* $\frac{44}{27}$
7. Divide $5\frac{1}{4}$ by $3\frac{1}{2}$. *Ans.* $\frac{42}{28}$
8. Divide $\frac{25}{30}$ by $\frac{15}{20}$. *Ans.* $\frac{10}{9}$
9. Divide $\frac{2}{3}$ of $\frac{3}{4}$ by $\frac{1}{2}$ of $\frac{2}{3}$. *Ans.* $1\frac{1}{2}$
10. Divide $\frac{5}{8}$ of $\frac{3}{4}$ by $4\frac{5}{8}$. *Ans.* $\frac{15}{164}$

CASE II.

ART. **99.** To divide a fraction by a whole number.

RULE.

Multiply the denominator of the fraction by the whole number, and write the product under the numerator. Or,

Divide the numerator of the fraction by the whole number when it can be done without a remainder, and write the quotient over the denominator.

QUESTIONS.—Art. 99. What is the rule to divide a fraction by a whole number? Explain the example.

Ex. Let it be required to divide $\frac{2}{3}$ by 6, and $\frac{8}{9}$ by 4

1. OPERATION.

$$\begin{array}{l} 2 \\ \overline{3} \times 6 = 18 \div 2 = 9 \end{array}$$

2. OPERATION.

$$\begin{array}{lr} 8 \div 4 = & 2 \\ \overline{9} & \overline{9} \end{array}$$

In the first example, we multiplied the denominator of the fraction by the whole number, and divided that product by the numerator; the result is 9.

In the second example, we divided the numerator of the fraction by the whole number, and wrote the quotient 2 over 9, the denominator of the fraction.

EXAMPLES FOR PRACTICE.

1. Divide $\frac{6}{13}$ by 3. *Ans.* $\frac{2}{13}$.
2. Divide $\frac{18}{19}$ by 6. *Ans.* $\frac{3}{19}$.
3. Divide $\frac{5}{11}$ by 5. *Ans.* $\frac{1}{11}$.
4. Divide $\frac{7}{8}$ by 12. *Ans.* $\frac{7}{96}$.
5. Divide $\frac{50}{75}$ by 25. *Ans.* $\frac{2}{75}$.
6. Divide $\frac{5}{7}$ by 9. *Ans.* $\frac{5}{63}$.
7. Divide $\frac{3}{13}$ by 10. *Ans.* $\frac{3}{130}$.
8. Divide $\frac{5}{8}$ of a dollar between 5 persons. *Ans.* $\frac{1}{8}$.
9. Divide $\frac{9}{16}$ of a yard into 9 equal parts. *Ans.* $\frac{1}{16}$.
10. Divide $\frac{3}{4}$ of a mile into 15 equal parts. *Ans.* $\frac{1}{20}$.

CASE III.

ART. 100. To divide a whole number by a fraction.

RULE.

Multiply the whole number by the denominator of the fraction, and divide the product by the numerator.

Ex. Let it be required to divide 5 by $\frac{3}{5}$.

OPERATION.

$5 \times 5 = 25 \div 3 = 8\frac{1}{3}$ It will here be observed, that we multiplied the whole number by 5, the denominator of the fraction, and divided the product by 3, the numerator; the result is $8\frac{1}{3}$,

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QUESTIONS.—Art. 100. What is the rule for dividing a whole number by a fraction? Explain the example.

EXAMPLES FOR PRACTICE.

1 Divide 18 by $\frac{2}{3}$. *Ans.* 27.
2. Divide 20 by $\frac{1}{4}$. *Ans.* 80.
3. Divide 5 by $\frac{1}{5}$. *Ans.* 25.
4. Divide 17 by $\frac{3}{4}$. *Ans.* 22$\frac{2}{3}$.
5. Divide 10 by $\frac{2}{5}$. *Ans.* 25.
6. Divide 12 by $\frac{3}{4}$. *Ans.* 16.
7. Divide 50 by $\frac{1}{4}$. *Ans.* 200.
8. Divide 75 by $\frac{3}{4}$. *Ans.* 100.
9. Divide 15 by 2$\frac{1}{2}$. *Ans.* 6.
10. Divide 16 by 3$\frac{1}{4}$. *Ans.* 4$\frac{12}{13}$.

MISCELLANEOUS EXERCISES IN VULGAR FRACTIONS

1. What will 7$\frac{1}{2}$lbs. of sugar cost, at 6$\frac{1}{4}$ cts. per lb.? *Ans.* 46$\frac{7}{8}$ cts.

2. What will 9$\frac{1}{8}$yds. cost, at 1.12\frac{1}{2}$ per yard? *Ans.* 10.26\frac{9}{16}$.

3. What will 10$\frac{3}{4}$lbs. of nails cost, at 4$\frac{3}{4}$ cts. per lb.? *Ans.* 0.51\frac{1}{16}$.

4. If one acre cost 14\frac{3}{4}$, what will $\frac{14}{103}$ of an acre cost? *Ans.* $2.004+.

5. If $\frac{7}{9}$ of a ton of hay cost $12, what will 5$\frac{1}{4}$ tons cost? *Ans.* $81.

6. If a man can walk 4$\frac{2}{7}$ miles in an hour, how far can he walk in 9 hours? *Ans.* 38$\frac{4}{7}$ miles.

7. Paid 212.99\frac{1}{5}$ for 1670$\frac{7}{10}$lbs. of coffee, what was that per lb.? *Ans.* 12$\frac{125}{167}$cts.

8. What is the value of $\frac{8}{9}$ of a furlong? *Ans.* 35rd 9ft. 2in.

9. What part of a yard is 2qr. and 1$\frac{5}{13}$in.? *Ans.* $\frac{7}{13}$.

10. What is the sum of $\frac{1}{5}$, $\frac{2}{5}$, $\frac{3}{5}$. $\frac{4}{5}$, and $\frac{5}{5}$? *Ans.* 3.

11. What is the sum of 6$\frac{3}{5}$, 7$\frac{8}{9}$, and 4$\frac{3}{8}$? *Ans.* 18$\frac{311}{360}$.

12. If I take $\frac{1}{4}$ from $\frac{3}{4}$, what will remain? *Ans.* $\frac{1}{2}$.

13. What is the sum of $\frac{7}{11}$ of a ton, and $\frac{17}{22}$ of a cwt.? *Ans.* 13cwt. 2qr.

14. What portion of a yard will be left if I take from it $\frac{1}{4}$ and $\frac{1}{2}$? *Ans* $\frac{1}{4}$.

15. From $\frac{3}{4}$ of a year take $\frac{3}{10}$ of a month? *Ans.* 8mo.21ds.

16. From $\frac{1}{4}$ of a day take $\frac{1}{2}$ of an hour? *Ans.* 5$\frac{1}{2}$ hours.

17. What is cloth per yard when $\frac{3}{4}$ of 7$\frac{1}{2}$yds. cost $30? *Ans.* 5\frac{1}{3}$.

18. Add together $\frac{3}{7}$ and $\frac{8}{9}$, and from their sum take $\frac{5}{21}$.
Ans. $1\frac{5}{63}$

19. What is the quotient of $17\frac{1}{4}$ divided by $\frac{1}{2}$? *Ans.* $34\frac{1}{2}$

20. From 7 weeks take $9\frac{7}{10}$ days. *Ans.* 5w. 4d. 7h. 12m

21. If $\frac{3}{4}$ of a yard cost $5, what will one yard cost?
Ans. $$6\frac{2}{3}$.

22. Sold $5\frac{1}{2}$ cords of wood for $25, what was this per cord?
Ans. $4.54.+

23. Multiply $2\frac{1}{2}$ by $1\frac{1}{7}$, and the product by $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{2}{3}$.
Ans. $\frac{5}{7}$

X+

SECTION XXVI.

RATIO AND PROPORTION.

Art. 101. Ratio is the relation which one number or quantity bears to another of the same kind. Ratio is of two kinds, *Arithmetical* and *Geometrical.*

The ratio is called arithmetical, when the comparison is made by considering *how much* one number or quantity exceeds another. Thus, the arithmetical ratio of 10 to 8 is 2, because 10 exceeds 8 by that number.

The ratio is called geometrical, when the comparison is made by considering *how often* one number or quantity will contain another. Thus, the geometrical ratio of 12 to 4 is $\frac{12}{4} = 3$; or that of 4 to 12 is $\frac{4}{12}$.

Art. 102. Every ratio consists of two numbers or quantities, called *terms.* The first is called the *antecedent*, and that with which it is compared, the *consequent.* Thus, in the preceding example, 12 is the antecedent, and 4 the consequent.

A ratio is called *direct*, when the antecedent is divided by the consequent. Thus, the direct ratio of 6 to 3, is $\frac{6}{3}$. A ratio is called *inverse*, when the consequent is divided by the antecedent. Thus the inverse ratio 6 to 3, is $\frac{3}{6} = \frac{1}{2}$.

Questions.—Art. 101. What is ratio? What is arithmetical ratio? Geometrical ratio?—Art. 102. Of what does every ratio consist? When is a ratio called direct? And when inverse?

Art. 103. A ratio may be expressed in two ways; either by two dots between the terms: thus, the ratio of 6 to 3 is 6 : 3, read 6 is to 3; or in the form of a fraction, by making the antecedent the numerator, and the consequent the denominator, thus, $\frac{6}{3}$.

There are two kinds of ratios, *simple* and *compound.*

A simple ratio has but one antecedent and one consequent.

A compound ratio consists of two, or more simple ratios, whose corresponding terms are multiplied together. Thus

The simple ratio of 6 : 3 is 2
And " " 12 : 4 is 3

The compound ratio of 72 : 12 is 6

Art. 104. If the terms of a ratio are both multiplied, or divided by the same number, the ratio is not changed, because the difference is the same. Thus, the ratio of 9 : 3, is 3; hence if we multiply or divide the terms by 3, the ratio will be the same; as, 9 × 3 : 3 × 3, is 3, or 9 ÷ 3 : 3 ÷ 3 is 3.

Art. 105. PROPORTION *is the equality of two ratios.*

A proportion is either *arithmetical* or *geometrical.* Four numbers are said to be in arithmetical proportion, when the difference between the first and second is equal to the difference between the third and fourth. Thus, 8, 6, 12 and 10, are in arithmetical proportion; because $8 - 6 = 12 - 10$.

Again, four numbers or quantities, are said to be in geometrical proportion, when the quotients arising from the division of the first by the second, is equal to the division of the third by the fourth: thus, the four numbers 8, 6, 12 and 10, are in geometrical proportion, because $\frac{8}{6} = \frac{12}{10}$.

Art. 106. A proportion is generally expressed by four dots written between the two ratios: as for example, the ratio of 4 to 8 and that of 12 to 24, is written in proportion thus, 4 : 8 :: 12 : 24, and is read, 4 is to 8 as 12 is to 24.

QUESTIONS.—Art. 103. How may a ratio be expressed? How many kinds of ratios? What is a simple ratio? A compound ratio?—Art. 104 If the terms of a ratio are multiplied, &c., what is said?—Art. 105. What is proportion? What is an arithmetical proportion? A geometrical?—Art 106. How is proportion expressed? What are the numbers forming a proportion called? The first and third? The second and fourth? What are the first and fourth? The second and third

The numbers which form a proportion, are called *terms* or *proportionals*.

The *first* and *third* terms of a proportion, are called *antecedents;* and the *second* and *fourth*, are called *consequents*

The *first* and *fourth* terms of a proportion, are called *extremes*, and the *second* and *third*, are called the *means*.

ART. **107.** THEORUM 1st. In an arithmetical proportion, the sum of the extremes is equal to the sum of the means: as in the proportion $8 : 6 :: 12 : 10$, we have $8 + 10 = 18$, and $6 + 12 = 18$.

THEORUM 2nd. In a geometrical proportion, the product of the extremes, is equal to the product of the means: as in the proportion $9 : 3 :: 12 : 4$, we have $9 \times 4 = 36$, and $3 \times 12 = 36$.

THEORUM 3rd. If the means, or middle terms of a proportion and *one* of the extreme terms be given, the *other* extreme may be formed by the following

RULE.

Divide the product of the means by the given extreme.

EXAMPLES FOR PRACTICE.

1. The first three terms of a proportion are 2, 3 and 4, what is the fourth term? *Ans.* 6.
2. The first three terms of a proportion are 1, 4 and 5; what is the other extreme? *Ans.* 20.
3. The two means of a proportion are 4 and 6, and one extreme 3; what is the other extreme? *Ans.* 8.
4. The first three terms of a proportion are 9, 6 and 6; what is the other extreme? *Ans.* 4.
5. The first three terms of a proportion are 6, 9 and 10; what is the fourth term? *Ans.* 15.
6. The first three terms of a proportion are 6, 2 and 1; what is the fourth? *Ans.* $\frac{1}{3}$.

QUESTIONS.—Art. 107. What is the first *theorum?* The second. The third? What is the rule for finding the unknown extreme?

SECTION XXVII.

SIMPLE PROPORTIONS,

OR

THE SINGLE RULE OF THREE.

Art. 108. The Single Rule of Three or *Simple Proportion* embraces a class of questions, in which three numbers or terms, in geometrical proportion, are given to find a fourth.

Note.—From what we have shown under the Section on Ratio and Proportion, the principles on which the Rule of Three is founded, will be readily understood; we will, therefore, proceed to elucidate these principles by the solution of a few questions.

Art. 109. It must be observed, that questions in the Rule of Three consist of two distinct parts: the STATEMENT and SOLUTION.

According to Art. 107, if we have the *two middle terms* of a proportion and one of the extreme terms, we can readily find the other extreme. Now the *statement* consists in the arrangement of the given numbers in proportion; and the *solution* consists in finding the unknown *extreme,* or answer.

Art. 110. Ex. Let it be required to solve the following question: If 4 yards of cloth cost $8, what will 12 yards cost at that rate? *Ans.* $24.

OPERATION.

$$\begin{array}{ccccc} \text{yds.} & & \text{yds.} & & \$. \\ 4 & : & 12 & :: & 8 \\ & & 8 & & \\ \hline \end{array}$$

$96 \div 4 = \$24$ the cost of 12yds.

Or thus,

$$\frac{12}{4} \times 8 = 96 \div 4 = 24$$

By inspecting this example, it is evident, that the 4th term, or value of the 12yds., must be as many times greater than $8, as 12 yards are greater than 4 yards. But as the quotient of 12 divided by 4, expresses how many times 12 is greater than 4, it follows that the fourth term, or unknown extreme, will be equal to $8 multiplied by this quotient: that is, equal to

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Questions.—Art. 108. What is the Rule of Three?—Art. 109. What is the statement and solution? Explain the example?

$8 multiplied by 3 = $24.. But we obtain the same result by multiplying the third term, $8, by the second term, 12, and dividing the product by the first term, 4. The same reasoning will hold good in every other proportion.

Note.—In the above example it will be observed, that we first made the statement of the question, by considering the ratio between the two terms of yards and the price of the 4 yards, and then by writing them in proportion, according to the directions given under Art. 106; and finally proceeded according to the *rule* given under Art. 107.

Solution by Analysis.—Any question in the Rule of Three may be solved by first finding the value of *one* yard, gallon, pound, &c., and then multiplying that value by the number of yards, &c., and the product will be the answer. Thus, in the preceding example, if 4 yards cost $8, *one* yard will cost ¼ of $8, or $2. Hence $2, the price of one yard, multiplied by 12 yards, will give $24, the price of the 12 yards.

Art. **111.** From the preceding examples, we deduce the following

RULE.

I. *Begin the statement of the question by making that number, which is of the same name or kind as the answer required, the third term. Then, if the answer required is to be greater than the third term, make the* LESS *of the other two numbers the first term, and the greater the second term. But if the answer required is to be less than the third term, make the* GREATER *of the other two numbers, the first term, and the less the second term.*

II. *Reduce the first and second terms to the lowest denominations mentioned in either, and the third term to its lowest given denomination.*

III. *Multiply the second and third terms together, and divide their product by the first term; the quotient will be the answer, in the same denomination as that to which the third is reduced.*

IV. *If any thing remains after division, reduce it to the next lowest denomination, and divide as before.*

Questions.—Explain the solution by analysis?—Art. 111. What is the rule? The proof?

V. *If the terms consist of fractions, state the question as in whole numbers and then multiply and divide according to the rules for the multiplication and division of fractions,* ARTS. 96 and 98.

PROOF.—*Multiply the first term and the answer, or fourth, together, and if the work be correct, their product will be equal to the product of the second and third terms. See* ART. 107

EX. 2. If 4bu. of wheat cost $5, what will 20bu. cost?

OPERATION.

1st term.		2d term.		3d term.		4th term.
4 bu.	:	20 bu.	::	$5	:	$25

$$\begin{array}{r} 20 \\ 5 \\ \hline 4)\,100 \\ \hline \$25\ \textit{Ans.} \end{array}$$

We state the question by making $5 the third term, because it is the same kind as the required answer. Then, since the answer must be greater than $5, we put 4, the *less* of the two terms of bushels, for the first term, and 20, the *greater*, for the second.

We then multiply the second and third terms together, and divide their product by the first term, and we have $25 for the fourth term.

PROOF.—If we multiply the *first* and *fourth*, the two extreme terms, together, we find that their product will be equal to the product of the second and third, the two *means*. Hence the work is correct.

$$\begin{cases} 4 \times 25 = 100 \\ 5 \times 20 = 100 \end{cases}$$

SOLUTION BY ANALYSIS.—If 4 bushels cost $5, one bushel will cost ¼ of $5, or $1.25; hence 20 bushels will cost 20 times as much as 1 bushel. Therefore, $1.25×20bu.=$25.

NOTE.—The work may be greatly abbreviated by cancelling the similar terms when it can be done, or reducing them, by dividing by any number that will divide them both without a remainder. Take, for example, the above question: 4bu. : 20bu. :: $5. Now if we divide the terms of bushels by 4, we will have 1bu. : 5bu. :: $5. Hence we have only to multiply 5bu. by $5, and we have the answer, $25, as before.

QUESTIONS.—Explain example 2d.?—*Note.* How may the work be abbreviated? Explain example 3d.?

Ex. 3. If 3 yards, 2 quarters of linen cost 1£. 5s. 8d., what will 20 yards cost at that rate?

OPERATION.

yd. qr. yd.

3 2 : 20 :: 1£. 5s. 8d.

4 4 20

14 qr 80 qr. 25

12

308

80

14)24640(1760d.

14

106

98

84

84

0

1760d. ÷ 12 = 146s. 8d.

146s. ÷ 20 = 7£. 6s. 8d. *Ans.*

In this example, it will be observed, that the first and third terms consist of different denominations, therefore, after making the statement, we reduced the first and second terms to quarters, and the third term to pence, the lowest given denomination.

Having made the reduction, we then multiplied the second and third terms together and divided the product by the 14qr., the first term. Lastly, we reduced the quotient, 1760d., to pounds and shillings: hence, 7£. 6s. 8d. is the cost of 20yds.

Ex. 4. If 4½ yards cost $9.75, what will 13½ yards cost?

OPERATION.

yd. yd.

4½ : 13½ :: $9.75

2 2

$\frac{9}{2}$ $\frac{27}{2} \times \$9.75 = \frac{2\text{[illegible]}3.25}{2}$

$\frac{263.25}{2} \div \frac{9}{2} = \frac{526.50}{18} = \$29.25$

When the terms consist of fractions, the statement is made precisely as in whole numbers.

In this example, as the first and second terms of the question consist of whole numbers and fractions, we first reduce them to improper fractions; then we multiplied $\frac{27}{2}$, the second term, by $9.75, according to the rule under Art. 97, for the multiplication of a fraction by a whole number; and divided the product by $\frac{9}{2}$, according to the rule for the division of fractions, Art. 98.

Note.—Let the pupil carefully examine the foregoing examples; and let him endeavor to perform them, not only by proportion, but also by analysis, and to practice cancellation whenever it will abbreviate the question. He should occasionally prove the questions he has performed, never depending on the correctness of the given answer. By attending to the above remarks, and by studying attentively the section on Ratio and Proportion of numbers, he will soon thoroughly understand the principles of the Rule of Three.

Division of the Rule of Three into *Direct* and *Inverse*, is now nearly obsolete.

EXAMPLES FOR PRACTICE.

1. If 3 yards of cloth cost $6, what will 9 yards cost? *Ans.* $18.

2. If 2lbs. of butter cost 50 cts., what will 6lbs. cost? *Ans.* $1.50.

3. What will 8lbs. of sugar cost, if 1lb. cost 7 cts. *Ans.* 56 cts.

4. What will a man earn in 25 days, at $1.25 per day? *Ans.* $31.25.

5. If 40 yards of linen cost $35, what will 1 yard cost? *Ans.* 87½ cts.

6. If 8 yards of cloth cost $3.20, what will 96 yards cost? *Ans.* $38.40.

7. How many yards of matting, 1 yard wide, will cover a floor 9 yards long, and 6 wide? *Ans.* 54yds.

8. What is the value of 2cwt. of sugar at 5d. per pound? *Ans.* 4£. 13s. 4d.

9. If 1 gallon of oil cost 75 cents, what will 16 gallons cost? *Ans.* $12

10. If 16 gallons of oil cost $12, what will 1 gallon cost? *Ans.* $0.75

11. If 1cwt. of sugar cost $6.25, what will three hogsheads cost, each weighing 9cwt. 2qr. 14lbs.? *Ans.* $180.46,8+.

12. If a man can cut 9.5 cords of wood in 3 days, how many cords can he cut in 15 days? *Ans.* 47.5 cords.

13. How many yards of linen may be bought for $28.50, when 6 yards cost $4.50? *Ans.* 38 yards.

14. If 1000 feet of boards cost $9.50, what will 21,000 feet come to? *Ans.* $199.50.

15. Bought 6 pieces of cloth, each piece 21 yards; what will they come to at $1.25 per yard? *Ans.* $157.50.

16. How many yards of cloth 3 quarters wide, will line 18 yards 5 quarters wide? *Ans.* 30yds.

17. Bought 4 pieces of linen, the first contained 25¼ yards, the second 23¾ yards, and the other two, each 27½ yards; what will the whole come to at 62½ cents per yard? *Ans.* $65.00.

18. If an ounce of silver be worth $1.25, what will 3 ingots come to, each weighing 1lb. 2oz. 10dwt.? *Ans.* $54.37½.

19. What will be paid for 87.5 gallons of wine at 87½ cts per gallon? *Ans.* $76.5625

20. If 9 barrels of flour be sufficient for 87 men 30 days, how many barrels will it take to supply 165 men for the same time? *Ans.* 17.06 barrels.

21. A. owes B. £500; but can only pay him 12s. 6d. in the pound; how much will B. receive? *Ans.* 312£. 10s

22. A man bought a hogshead of molasses containing 73 gallons for $20.44; how much did it cost him per gallon, and per quart? *Ans.* 28cts. per gal. 7 cts. per qt.

23. If 3 pounds of sugar cost 4 shillings, what w[illegible] pounds cost? *Ans.* 8s.

24. How much will 75 pounds of almonds come to at 37½ cents per pound? *Ans.* $28.12½.

25. If 1 dozen of penknives cost $2.50, how much will 4 dozen come to? *Ans.* $10.00.

26. Bought 156 pounds of soap for $15.60, what is the price per pound? *Ans.* 10cts.

27. How many yards of paper, 2½ feet wide, will be required to cover a wall, which is 12 feet long, and 9 feet high? *Ans.* 14.4yds.

28. What is the price of 4½ pounds of tea, at 75 cents per pound? *Ans.* $3.37½.

29. If the price of one acre of land be $18.25, what will 50 acres, 2 roods, and 20 perches come to? *Ans.* $923.906 +.

30. If 1.5 yards of silk cost $2.50, what will 1.125 quarters cost? *Ans.* $0.46.87 +

31. What will four pieces of cloth come to, containing 23, [illegible]4, 25 and 27 yards, at 72 cents per yard? *Ans.* $71.28

32. ~~What will~~ 35 cords of wood cost, at $3.87,5 per cord? *Ans.* $135.62,5.

33. If 3 pounds of beef cost 25 cts., what will 15$\frac{1}{2}$lbs. cost? *Ans.* $1.29,1.

34. If the price of 1 yard of muslin be 9 cts., how many yards can I buy for $2.88? *Ans.* 32yds.

35. If a person's income be $800 a year, how much does he receive per day? *Ans.* $2.19 +.

36. If a man have a salary of $1,333 a year, and spend daily $2.14; how much will he save in the year? *Ans.* $551.90.

37. How many perches in length, with 6 in breadth, must I receive in exchange for 40 perches in length and 12 in breadth? *Ans.* 80 perches.

38. If 5 men can build a wall in 21 days, how many men will be required to build it in 7 days? *Ans.* 15 men.

QUESTIONS INVOLVING FRACTIONS.

39. If $\frac{3}{4}$ of a yard cost $\frac{5}{8}$ of a dollar, what will $\frac{11}{12}$ of a yard cost? *Ans.* 0.76\frac{7}{18}$.

40. If $\frac{1}{8}$ of a barrel of flour cost $\frac{2}{5}$ of a dollar, what will $\frac{5}{16}$ of a bar[illegible] cost? *Ans.* $1.

41. I[illegible]bs: of beef cost $\frac{1}{8}$ of a dollar, what will 30lbs. cost? *Ans.* 1.87\frac{1}{2}$.

42. If 1lb. of sugar cost 6$\frac{1}{4}$ cents, what will 37$\frac{1}{2}$lbs. cost? *Ans.* 2.34\frac{3}{8}$.

43. If $\frac{2}{3}$ of a gallon cost $\frac{3}{8}$ of a dollar, what will 5$\frac{1}{2}$ gallons come to? *Ans.* $3.09 3.

44. If 50 bushels of wheat cost 17$\frac{2}{3}$£., what is it per bush? *Ans.* 7s. 0$\frac{1}{2}\frac{2}{3}$d.

45. A merchant sold 5$\frac{1}{2}$ pieces of cloth, each containing 24$\frac{1}{3}$yds. at 9s. 0$\frac{1}{2}$d. per yard; what did the whole amount to? *Ans.* 60£. 10s. 0$\frac{1}{1}\frac{1}{2}$d.

46. If 178$\frac{1}{2}$ yards cost $25.50, what will 29$\frac{3}{4}$ yards come to? *Ans.* $4.25.

47. How many yards of baize, 1$\frac{1}{4}$yds. wide, will line 18$\frac{7}{8}$ yds. of camlet $\frac{3}{4}$yd. wide? *Ans.* 11yd. 1qr. 1$\frac{1}{5}$n.

48. If 13 men in 11$\frac{2}{3}$ days, mow 21$\frac{1}{2}$ acres; how long will it take 8 men to do the same? *Ans.* 18$\frac{23}{24}$ days.

49. How many yards of carpeting 2$\frac{1}{2}$ wide, will cover a floor 30 feet long and 15 wide.

[illegible] Three

50. If $3\frac{1}{2}$ apples cost $3\frac{1}{2}$ cents, what will $9\frac{1}{2}$ apples cost at that rate?

51. If 9 peaches cost $12\frac{1}{2}$ cents, what will one peach cost?

52. If a boy received $37\frac{1}{2}$ cents for one day's work, what will he receive for $16\frac{1}{2}$ day's work?

SECTION XXVIII.

Sect

DOUBLE RULE OF THREE,

OR COMPOUND PROPORTION.

Art. 112. The Double Rule of Three, or Compound Proportion teaches the method of solving such questions, as require two or more statements in the Single Rule of Three or Simple Proportions.

Note.—*Compound Proportion* is simply an expression of the equality between a compound and simple *ratio*. See Art. 103.

Ex. 1. If 2 men expend $100, in 8 months, how many dollars will be sufficient for 5 men for 20 months?

[illegible]. $625

OPERATION.

$$\begin{array}{llcll} \text{extreme.} & \text{mean.} & & \text{mean.} & \text{extreme.} \\ 2\text{men} & :\ 5\text{men} & \multirow{2}{*}{\Big\}\ ::} & \$100 & :\ \$625. \\ 8\text{mo} & :\ 20\text{mo} & & & \\ \hline 16 & 100 \times 100 = \$10000 & & & \end{array}$$

$$\$10000 \div 16 = \$625$$

In stating this question, we make $100, which is of the same kind as the answer required, the third term. Then taking the two terms of men, we inquire if the answer depending on them alone, must be greater or less than the third; and by inspecting them, we find that it must be greater, since 5 men will expend more than 2; hence we make 2 men the *first* term, 5 the *second*. Again, we take the two terms of months, and by comparing them with the third, we find that more would be expended in 20 months than in 8mo.; hence we make 8 mo. the first term, and 20mo. the second.

Questions.—Art 112. What does the Double Rule of Three teach What is Compound Proportion the expression of? Explain the operation.

We then multiplied the product of the second terms by the third term; and divided this product by the product of the first terms. Hence the following

RULE.

I. *Make that number, which is of the same kind as the answer required, the third term; and, of the remaining numbers, take any two, that are of the same kind, and consider whether an answer, depending upon these alone, would be greater or less than the third term, and place them as directed in Simple Proportion.*

II. *Then take two other terms of the same kind, and consider whether an answer, depending only upon them, would be greater or less than the third term, and arrange them accordingly; and so on until all are used.*

III. *Multiply the continued product of the second terms by the third, and divide by the continued product of the first terms, and the quotient will be the answer.*

NOTE.—All questions under the Double Rule of Three may be performed by analysis, and frequently shortened by cancellation.

Ex. 2. If $100 will gain $6 in 12 months, what will $500 gain in 8 months? *Ans.* $20.

OPERATION BY ANALYSIS

$$\left.\begin{array}{l}\$100 : \$500\\ 12\text{mo.} : \ 8\text{mo.}\end{array}\right\} :: \$6$$

If $6 be the gain of $100 for 12 months, in 1 month the gain will be $\frac{1}{12}$ of $6, or $\frac{6}{12}$, and in 8 months it will be 8 times as much, or $\$6 \times 8 \div 12$. Again, if $100 gain $\$6 \times 8 \div 12$ in 8 months, $1 will gain $\frac{1}{100}$ of it, or $\$6 \times 8 \div 12 \times 100$, and $500 will gain 500 times as much, or $\$6 \times 8 \times 500 \div 12 \times 100$. By performing the operation indicated, we obtain $20 for the answer.

Ex 3. If 12 oxen in 16 days eat 20 acres of grass, how many acres will serve 24 oxen for 48 days? *Ans.* 120 acres.

QUESTIONS.—Art. 112. What is the rule? In what other way may all questions under the Double Rule of Three be performed? Explain examples 2d and 3d? When the terms of the ratio cannot be entirely cancelled, how may the work be abbreviated?

OPERATION BY CANCELLATION.

12) ~~12~~ox. : 24ox. } :: 20 acres.
16) ~~16~~d. : 48d }

1ox. : 2ox.
1d. : 3d.

6 × 20 = 120 *Ans.*

Under Art. 104, we found, that if both terms of a ratio are multiplied or divided by the same number, the ratio remains the same: hence, in this example, we divided the first ratio by 12. and the second by 16, because we found that these numbers would cancel the first terms of the ratios and reduce the second terms to lower numbers. We then multiplied the second terms together, and their product by 20, the third term, and obtained 120 for the answer.

NOTE.—When the terms of the ratio cannot be entirely cancelled, they may be reduced, and the work may thus be abbreviated, by *dividing the terms by any number that will divide them without a remainder.*

ART. **113.** *To perform the operation by two or more statements.*

Ex. 4. If 6 men spend $300 in 8 months, how much will 15 men spend in 20 months? *Ans.* $1,875

OPERATION.

1st statement.
men. men. $.
6 : 15 :: 300
300
6)4500=$750

2nd statement.
mo. mo. $. $.
8 : 20 :: 750 : 1875
20
8)15000
1875 *Ans.*

In the first statement, we took the two terms of men and compared them in reference to the money, and inquired if $300 will be sufficient for 6 men 8 months, how many dollars will be sufficient for 15 men for the same. We stated the question, and performed the operation according to the rule given under Simple Proportion, and we obtained $750 for the answer.

In the second statement, we took the two terms of months and compared them to $750, the answer we obtained by the

---

QUESTION.—Art. 113. Explain the method of solving the Double Rule of Three by two or more statements.

first statement, and inquired, if $750 will be sufficient for 15 men for 8 months, what sum will serve them for 20 months. After performing the operation as in the first statement, we obtain $1875, the same answer as would have been obtained, had the question been solved by one statement. Hence, any question in Compound Proportion may be solved by two or more statements.

EXAMPLES FOR PRACTICE.

1. If the wages of 6 men for 14 days be $84, what will be the wages of 9 men for 20 days? *Ans.* $180.

2. If 9 men can build 36 feet of wall in 6 days, how many feet of wall can 12 men build in 15 days? *Ans.* 120ft. wall

3. If 10 bushels of oats be sufficient for 18 horses 20 days, how many bushels will be sufficient for 60 horses 36 days? *Ans.* 60 bushels.

4. If 3 persons, in 4 days, eat 6 pounds of bread, how much bread will be sufficient for 6 persons, 12 days? *Ans.* 36lbs.

5. If 8 men spend $32 in 13 weeks, what will 24 men spend in 52 weeks? *Ans.* $384.

6. If $100 gain $6 in 12 months, what sum will gain $10 in 4 months? *Ans.* $500.

7. If the carriage of 5cwt. 3qr., 150 miles, cost $24.58, what must be paid for the carriage of 7cwt. 2qr. 25lb., 64 miles? *Ans.* $14.08,6.

8. If 300 pounds of beef serve 40 men 15 days, how many pounds will serve 120 men for 25 days? *Ans.* 1500lb.

9. If 9 men can cut 36 acres of grass in 14 days, how many acres will 19 men cut in 11 days? *Ans.* 59.7 acres.

10. If 32 men build a wall 36 feet long, 8 feet high and 4 feet wide, in 4 days; in what time will 48 men build a wall 864 feet long, 6 feet high and 3 feet wide? *Ans.* 36 days.

11. If 7¼oz. of bread be bought for 4¾d. when wheat is 4s. 2d. per bushel; how many ounces may be bought for 1s. 2d. when the price is 5s. 6d. per bushel. *Ans.* $16\frac{118}{627}$oz.

12. If 9 men can cut 36 acres of grass in 4 days, how many acres will 19 men cut in 11 days? *Ans.* 209 acres

SECTION XXIX.

PRACTICE.

ART. **114.** PRACTICE is a short method of finding the value of any number or quantity of goods.

It is called Practice from its general application. All the questions under this rule may be solved by the Rule of Three; but they are much more readily performed by taking *aliquot* parts.

An *aliquot* part, means a part which will divide the whole number, of which it forms a portion, without any remainder: as, 1 quarter is an aliquot of a yard.

ART. **115.** The following is a table of

ALIQUOT PARTS.

MONEYS.					
Cents.	$.	Shillings.	£.	Pence.	Shillings.
5 equal to	1/20	1s. 8d. equal to	1/12	1 equal to	1/12
6¼ “	1/16	2s. 6d. “	1/8	1½ “	1/8
12½ “	1/8	3s. 4d. “	1/6	2 “	1/6
20 “	1/5	4s. “	1/5	3 “	1/4
25 “	1/4	5s. “	1/4	4 “	1/3
33⅓ “	1/3	6s. 8d. “	1/3	6 “	1/2
50 “	1/2	10s. “	1/2		
75 “	3/4				

WEIGHT.				TIME.			
Lbs.	Cwt.	Cwt.	Ton.	Months.	Year.	Days.	Month.
7 equal to	1/16	2 equal to	1/10	2 equal to	1/6	3 equal to	1/10
14 “	1/8	4 “	1/5	3 “	1/4	5 “	1/6
28 “	1/4	5 “	1/4	4 “	1/3	6 “	1/5
56 “	1/2	10 “	1/2	6 “	1/2	7½ “	1/4
						10 “	1/3
						15 “	1/2

QUESTIONS.—Art. 114. What is Practice? Why is it called so? How may the questions under this rule be performed? What is an aliquot part?

UNITED STATES MONEY.

CASE I.

Art. 116. When the price is less than a cent.

RULE.

Divide the given number by the aliquot parts of a cent, and the quotient will be the answer in cents.

Ex. What will 500 yards of tape cost, at ½ cent per yard?

OPERATION.

½)500 yards.

$2.50 *Ans.*

½)322

35-0

Examples for Practice.

1. What will 1000 quills cost, at ¼ of a cent per quill? *Ans.* $2.50.
2. What will 500 slate pencils cost, at ¼ of a cent a piece? *Ans.* $1.25.
3. What will 300 dozen of pins cost, at ½ of a cent per doz.? *Ans.* $1.50
4. What will 25 apples cost, at ½ of a cent per apple? *Ans.* $0.12½.
5. What will 100 cakes cost, at ¾ of a cent per cake? *Ans.* $0.75.
6. What will 500 marbles cost, at ⅕ of a cent a piece? *Ans.* $1.00.
7. What will 2000 quills cost, at ⅛ of a cent per quill? *Ans.* $2.50.

CASE II.

Art. 117. When the price is cents and parts of a cent.

RULE.

Multiply the given number by the cents, and divide by the aliquot parts of a cent.

Questions.—Art. 116. What is the rule, when the price is less than a cent?—Art. 117. What is the rule, when the price is cents and parts of a cent?

EXAMPLES FOR PRACTICE.

1. What will 20lbs. of rice cost, at 4½ cents per lb.?
Ans. $0.90

2. What will 75lbs. of sugar cost, at 5½ cents per lb.?
Ans. $4.12½.

3. What will 28 yards of calico cost, at 6¼ cents per yd.?
Ans. $1.75

4. What will 4lbs. of cheese cost, at 12½ cents per lb.?
Ans. $0.50

5. What will 8lbs. of butter cost, at 18¾ cents per lb.?
Ans. $1.50

6. What will 140yds. of tape cost, at 2¼ cents per yard?
Ans. $3.15.

7. What will 438 bushels of apples cost, at 31¼ cents per bushel? *Ans.* $136.87½

8. What will 20yds. of linen cost, at 62½ cents per yard?
Ans. $12.50.

9. What will 16lbs. of soap cost, at 9¼ cents per pound?
Ans. $1.48.

10. What will 25 dozen of eggs cost, at 14½ cents per dozen? *Ans.* $3.62½.

CASE III.

When the price is any part of a dollar.

RULE.

Divide the given number by the aliquot parts of a dollar

EXAMPLES FOR PRACTICE.

1. What will 20 yards of linen cost, at 50cts. per yard?
50cts.=$½)20=*Ans.* $10.00.

2. What will 16lbs. of butter cost, at 25cts. per pound?
Ans. $4.00

3. What will 30lbs. of tea cost, at 75cts. per pound?
Ans. $22.50.

4. What will 24lbs. of coffee cost, at 12½ cents per pound?
Ans. $3.00

5. What will 12 yards of calico cost, at 12½ cents per yard? *Ans.* $1.50

6. What will 20lbs. of sugar cost, at 6¼ cents per pound? *Ans.* $1.25.

7. What will 12lbs. of soap cost, at 6¼ cents per pound? *Ans.* $0.75.

8. What will 20lbs. of rice cost, at 5 cents per pound? *Ans.* $1.00

9. What will 35 bushels of potatoes cost at 50cts. per bushel? *Ans.* $17.50.

10. What will 150 bushels of apples cost, at 75 cents per bushel? *Ans.* $112.50.

11. What will 75 gallons of oil cost, at 75 cents per gallon? *Ans.* $56.25

12. What will 90 dozen of eggs cost, at 12½ cents per dozen? *Ans.* $11.25

CASE IV.

When the price consists of dollars and cents

RULE.

Multiply the given number by the dollars, and divide by the aliquot parts of a dollar, for the cents.

Ex. What will 10 gallons of wine cost, at $2.12½ per gallon? *Ans.* $21.25.

OPERATION.

```
⅛)10   12½=$⅛
   2
  ——
  20
   1.25
  —————
$21.25 Ans.
```

We first multiplied the 10 gallons by $2; then, as 12½ cents, is the ⅛ of a dollar, we divided 10 by ⅛, and added the quotient to the former product. Hence, we obtained $21.25 as the price of the 10 gallons.

Examples for Practice.

1. What will 15 yards of cloth cost at $2.25 per yard? *Ans.* $33.75.

2. What will 20 yards of silk cost, at $1.50 per yard? *Ans.* $30.00.

375
25

£5

3 What will 25 pair of boots cost, at $3.75 per pair? *Ans.* $93.75

4. What will 50oz. of gold dust come to at $15.12½ per oz.? *Ans.* $756.25.

5. What will 65cwt. of iron cost, at $8.50 per cwt.? *Ans.* $552.50

6. What will 250 bushels of wheat cost, at $1.06¼ per bushel? *Ans.* $265.62½

7. What will 1570 barrels of flour cost at $5.20 per barrel?

8. What will 175 acres cost, at $35.87½ per acre?

ENGLISH MONEY.

CASE I.

ART. **118.** When the price is less than a penny.

RULE.

Divide the given number by the aliquot parts of a penny, and the quotient will be the answer in pence, which reduce to shillings or to pounds, if necessary.

Ex. What will 300 yards of tape cost at ¾d. per yard?

OPERATION.

$$\begin{array}{c|c|r} \frac{1}{2} & \frac{1}{2} & 300 \\ \hline \frac{1}{4} & \frac{1}{2} & 150 \\ & & 75 \\ \hline \end{array}$$

$12)\underline{225}$

Ans. 18s. 9d.

As ¾ is equal to ½ and ¼, we wrote these two fractions over each other on the left hand of the given number; and then divided by the ½, and we obtained for the first quotient 150. But as a ¼ is equal to the half of a half, we divided the first quotient again by ½, which gives 75 for the quotient. We then added the two quotients together and divided the sum by 12, and obtained 18s. 9d. for the answer.

EXAMPLES FOR PRACTICE.

1. What will 72yds. of tape cost at ½d. per yard? *Ans.* 3s.
2. What will 420yds. of ribbon cost at ¾d. per yard? *Ans.* 26s. 3d.
3. What is the value of 7,672 eggs, at ¼d. a piece? *Ans.* 7£. 19s. 10d.

QUESTION.—Art 118. What is the rule for Case I?

4. What is the value of 6,812 peaches at ½d. a piece?
Ans. 14£. 3s. 10d.

5 What is the value of 36 oranges, at ¾d. per orange?
Ans. 2s. 3d

6. What is the value of 7doz. lemons, at ¼d. a piece?
Ans. 1s. 9d

7 doz

CASE II.

When the price is pence and parts of a penny.

RULE.

Divide the given number by the aliquot part or parts of a shilling; and reduce the sum to pounds. Or,

Multiply by the pence and take parts of the penny, and the sum will be the answer in pence, which reduce to shillings and pounds, if necessary.

Examples for Practice.

1. What will 25 yards of muslin cost, at 2½d. per yard?
Ans. 3s. 2½d

½|25
2
50
12½

62½ = 3s. 2½d.

2. What will 16 dozen of eggs cost, at 4¼d. per dozen?
Ans. 5s. 8d.

3. What will 9lbs. of sugar cost, at 5¾d. per lb.
Ans. 4s. 3¾d.

4. What will 36lbs. of candles cost, at 6¼d. per lb.?
Ans. 18s. 9d.

5. What will 125 yards of calico cost, at 9½d. per yard?
Ans. 4£. 18s. 11½d

6. What will 1,865lbs. of coffee cost, at 10¾d.
Ans. 83£. 10s. 8¾d

7. What will 52lbs. of cheese cost, at 8½d. per lb?
Ans. £1. 16s. 10d

Question.—Case II. What is the rule, when the price is pence and parts of a penny?

8. What will 45lbs. of rice cost, at 1¾d. per lb.?
Ans. 6s. 6¾d

CASE III.

When the price is shillings, pence and farthings

RULE.

Multiply the given number by the shillings, and take aliquot parts of a shilling, for the pence and farthings. Or, take such aliquot parts of the given quantity, as the price is of a pound.

Ex. What is the value of 150 yards, at 6s. 9d. per yard? and at 5s. 3½d.?

1. OPERATION.

```
6|½| 150
 | |   6
 | | ───
 | | 900
3|½|  75
 | |  37  6
──────────
20)1012  6
──────────
  50£. 12s. 6d.
```

2. OPERATION.

```
4|⅕| 150
 | | ───
1|¼|  30
3|¼|   7 10
½|⅙|   1 17 6
       0  6 3
     ─────────
   39£. 13s. 9d.
```

EXAMPLES FOR PRACTICE.

1. What is the value of 69lbs. of sugar, at 2s. 4d. per lb.?
Ans. 8£. 1s.
2. What will 25 yards of muslin cost, at 3s. 6d. per yard?
Ans. 4£. 7s. 6d
3. What will 75lbs. of candles cost, at 1s. 7½d. per lb.?
Ans. 6£. 1s. 10½d
4. What will 193yds. of linen cost, at 9s. 7¼d. per yard?
Ans. 92£. 13s. 7¼d
5. What will 789 gallons of wine cost, at 16s. 8d. per gal.?
Ans. 657£. 10s.
6. What will 180 bushels of potatoes cost, at 5s. 10¾d. per bushel?
Ans. 53£. 1s. 3d

QUESTION.—What is the rule, when the price is shillings, pence, &c

CASE IV.

When the price is pounds and shillings, or pounds, shillings, pence and farthings.

RULE.

Multiply the given number by the pounds, and take aliquot parts for the rest.

Ex. What will 428 tons of iron cost, at 3£. 4s. 6½d. per ton ?

OPERATION.

4	⅕	428		
		3		
		1284		
6	⅛	85	12	
		10	14	
½	$\frac{1}{12}$	0	17	10
		1381£.	3s.	10d.

EXAMPLES FOR PRACTICE.

1. What is the value of 36cwt. of iron, at 5£. 13s. per cwt.? *Ans.* 203£. 8s.

2. What will 25 barrels of flour cost, at 2£. 16s. 6d. per barrel ? *Ans.* 70£. 12s. 6d.

3. What will 1540cwt. of bacon cost, at 4£. 10s. 9½d. per cwt. ? *Ans.* 6990£. 19s. 2d.

4. What will 175 acres cost, at 15£. 19s. 11d. per acre ? *Ans.* 2799£. 5s. 5d.

5. What will 45cwt. of tobacco cost, at 12£. 15s. 5¼d. per cwt. ? *Ans.* 574£. 14s. 8¼d.

ART. **119.** When both the price and given quantity are of several denominations.

RULE.

Multiply the price by the highest denomination of the given quantity, and take aliquot parts for the lower denominations Add the results together for the answer.

QUESTIONS.—What is the rule, when the price is pounds, shillings, &c. ?—Art. 119. What is the rule, when the price and given quantity are of several denominations ?

Ex. What is the value of 8cwt. 1qr. 14lb. of tobacco at $30.25 per cwt.

OPERATION.

$$\begin{array}{r|c|r}
\text{1qr.} & \frac{1}{4} & \$30.25 \\
 & & 8 \\ \cline{3-3}
 & & 242.00 \\
\text{14lbs.} & \frac{1}{2} & 7.56\frac{1}{4} \\
 & & 3.78 \\ \cline{3-3}
\multicolumn{3}{r}{\$253.34\frac{1}{4}\ \textit{Ans.}}
\end{array}$$

EXAMPLES FOR PRACTICE.

1. What will 20yds. 2qr. cost, at $2.50 per yard? *Ans.* $51.25cts

2. What will 15 gallons, 3qt. of wine cost, at $1.25 per gallon? *Ans.* $19.68¾

3. What will 35lb. 8oz. of indigo cost, at $5.75 per lb.? *Ans.* $204.12,5

4. What will 137gal. 2qt. 1pt. of wine cost, at $1.37½ per gallon? *Ans.* $189,23cts,43m.

5. What will 9cwt. 2qr. 21lb. cost, at 5£. 11s. 6¼d. per cwt.? *Ans.* 54£. 0s. 6$\frac{2}{3}\frac{3}{2}$d.

6. What will 14yds. 1qr. of cloth cost, at $4¾ per yard? *Ans.* $67.68,75

7. What will 51½ tons of hay cost, at $9.87½ per ton? *Ans.* $508.56,25

8. What will 6gal. 1qt. 1pt. 2 gills of wine cost, at 5s. 4d per quart? *Ans.* 6£. 17s. 4d.

9. What will 131½lb. of cheese cost, at 1s. 2d. per lb.? *Ans.* 7£. 13s. 5d.

10. What is the value of 144cwt. 2qr. 21lb. of rice, at $9.30 per cwt.? *Ans.* $1345,59,37+.

11. A merchant sold 289cwt. 1qr. 14lb. of beef, at $4.65 per cwt.; the value is required? *Ans.* $1345.59,3+

12. What is the value of 11[illegible] acres, at $15.73 per acre? *Ans.* $18,195.61.

SECTION XXX.

TARE AND TRET.

Art. 120. **Tare and Tret** are allowances made in selling goods by weight.

The terms used are *Gross Weight*, *Tare*, *Tret* and *Neat Weight*.

Gross Weight is the weight of the goods, together with the box, barrel, bag, &c., which contains them.

Tare is the allowance made to the buyer, for the weight of the box, barrel, &c.

Tret is an allowance of 4 pounds in every 104 pounds, for waste, dust, &c.

Suttle is the weight that remains after deducting the *tare*, when *tret* is allowed.

Neat or *Net* weight is that which remains after all allowances are made.

CASE I.

Art. 121. *When the tare is so much on the whole gross weight.*

RULE.

Subtract the tare from the gross, and the remainder will be neat weight.

Ex. What is the neat weight of 125cwt. 2qr. 20lbs. of tobacco, tare on the whole, 4cwt. 3qr. 15lbs.?

OPERATION.

cwt.	qr.	lb.	
125	2	20	*Gross.*
4	3	15	*Tare.*
120	3	5	*Net.*

It will be seen by this example, that we arranged the numbers and proceeded in the operation, according to the rule for Compound Subtraction. See Art. 52.

Note.—If the value of the whole neat weight be required, at a given price per cwt., the operation may be performed by the Rule of Three or by Practice.

Questions.—Art. 120. What are Tare and Tret? What is Gross Weight? Tare? Tret? Suttle? Neat Weight?—Art. 121. What is the rule when the tare is so much on the gross?

EXAMPLES FOR PRACTICE.

1. A man bought 35 boxes of raisins, weighing 9cwt. 3qr 25lb., gross; what is the neat weight, allowing 1cwt. 2qr 26lb. tare? *Ans.* 8cwt. 0qr. 27lb

2. If the gross weight of 25 bags of coffee is 35cwt. 1qr 18lb., and the tare 3cwt. 2qr. 27lb., what is the neat weight? *Ans.* 31cwt. 2qr. 19lb.

3. What is the neat weight of a firkin of butter, the gross weight 65lb., and tare 14lb.; and what will it come to at 12½ cents per pound? *Ans.* 51lb. neat wt., $6.37½ price.

4. What is the neat weight of 38 hogsheads of tobacco, weighing 202cwt. 3qr. 10lb. gross, the tare upon it being 3140lbs.? *Ans.* 174cwt. 3qr. 6lb.

5. What is the neat weight of a box of candles, that weighs 56lb. gross, the weight of the box being 7½lb.? *Ans.* 48½lb.

6. What is the neat weight of 15 kegs of lard, the gross weight 3cwt. 2qr. 21lb., the tare upon the whole 2qr. 26lb.? *Ans.* 2cwt. 3qr. 23lb.

7. What is the neat weight of 3 boxes of prunes; the *first* weighing 1cwt. 2qr. 10lb. gross, tare 18lb.; the *second*, 1cwt. 3qr. 19lb. gross, tare 21lb.; and the *third*, 0cwt. 3qr. 27lb. gross, tare 13lb.? *Ans.* 4cwt. 0qr. 4lb.

8. A man bought 5 hogsheads of tobacco, weighing as follows: No. 1, 9cwt. 2qr. 15lb. gross, tare 2qr. 10lb. No. 2, 8cwt. 1qr. 25½lb. gross, tare 1qr. 25¼lb. No. 3, 7cwt. 0qr. 18lb. gross, tare 2qr. 4¾lb. No. 4, 7cwt. 3qr. gross, tare 1qr. 19lb. No. 5, 6cwt. 3qr. 21½lb. What is the neat weight, and value at $8.50 per cwt.?

CASE II.

ART. 122. When the tare is at so much per box, bag, &c.

RULE.

Multiply the number of boxes, bags, &c. by the tare, and subtract the product from the gross, and the remainder will be the neat weight.

QUESTION.—Art. 122. What is the rule when the tare is at so much per box, bag, &c.?

Ex. What is the neat weight of 9 boxes of raisins, weighing 195 pounds gross, tare per box 4 pounds?

OPERATION.

9 number of boxes.	195 gross.
4 tare per box.	36
36 tare on the whole.	159 neat weight.

EXAMPLES FOR PRACTICE.

1. What is the neat weight of 15 bags of coffee, weighing 10cwt. 3qr. 18lb. gross, the tare per bag 4lb.?
Ans. 10cwt. 1qr. 14lb.

2. What is the neat weight of 10 boxes of candles, weighing 5cwt. 3qr. 14lb. gross, tare per box 9lb.?
Ans. 5cwt. 0qr. 8lb.

3. What is the neat weight of 6 boxes of soap, weighing 3cwt. 2qr. 21lb. gross, tare per box 13lb.?
Ans. 2cwt. 3qr. 27lb

4. What is the neat weight of 35 bales of silk, each weighing 317lb. gross, tare 16lb. per bale? *Ans.* 10,535lb.

5. What is the neat weight of 6 casks of indigo, each weighing 2cwt. 3qr. 21lb.; tare per cask 1qr. 5lb.?
Ans. 15cwt. 3qr. 12lb.

6. What is the neat weight of 40 kegs of figs, gross weight 5cwt. 3qr. 9lb.; tare per keg 5¼lb.? *Ans.* 3cwt. 3qr. 13lb.

7. What is the neat weight of 25 boxes of soap, weighing 1250lb. gross; tare 7lb. per box? and what is the value thereof, at 8¼cts. per lb.? *Ans.* 1,075lb. $88.68¾

CASE III.

ART. **123.** When the tare is so much per cwt.

RULE.

Divide the gross by such aliquot part or parts of it as the tare is per cwt.; then subtract the quotient from the gross, and the remainder will be the neat. Or,

Multiply the pounds gross by the tare per cwt., and divide the product by 112; the quotient will be the tare; then subtract this quotient from the gross, and the remainder will be the neat.

Ex. What is the neat weight of 75cwt. 3qr. 12lbs.; tare per cwt. 14lbs.?

1.

OPERATION.

14lb. ⅛ of	cwt.	qr.	lb.
⅛	75	3	12
	9	1	26
Neat	66	1	14

2.

OPERATION.

cwt.	qr.	lb.
75	3	12

$75\times4+3=303\times28+12=8468$lb

$8468\times14=118552\div112$

Note.—When the given question consists of cwt. qrs. and lbs., at so many pounds per cwt., the tare may be found by working according to the rule under Compound Multiplication.

Examples for Practice.

1. What is the neat weight of 37cwt. 1qr. 20lb.; tare per cwt. 14lb.? *Ans.* 32cwt. 3qr.

2. What is the neat weight of 6 hogsheads of sugar, each weighing 8cwt. 2qr. 14lb. gross; tare 16lb. per cwt.? *Ans.* 44cwt. 1qr. 12lb.

3. What is the neat weight of 40 kegs of figs, gross 75cwt. 3qr. 12lb.; tare per cwt. 14lb.? *Ans.* 66cwt. 1qr. 14lb.

4. What is the neat weight of 43cwt. 3qr. 21lb. gross; tare per cwt. 12lb.? *Ans.* 39cwt. 0qr. 25lb. 12oz.

CASE IV.

Art. **124.** When both tare and tret are allowed.

RULE.

Find the tare as before, and subtract it from the gross; divide the remainder, or SUTTLE *by 26, and the quotient will be the* TRET. *Subtract the tret from the suttle, and the remainder will be the neat weight.*

Ex. What is the neat weight of 8cwt. 3qr. 20lbs. gross, tare 38lbs., tret 4lbs. in every 104lbs.?

Questions.—Art. 123. What is the rule when the tare is so much per cwt.? What is observed in the note?—Art. 124. What is the rule, when both tare and tret are allowed?

OPERATION.

```
cwt. qr. lb.                              Suttle.
 8   3   20                          26)962(37 tret.
 4                                      78
 —              lbs.                    ——
35×28+20=1000 gross.                    182
           38 tare.                     182
           ——                           ——
          962 suttle.                            4
           37
           ——
          925 lb. neat.
```

In this example, we first reduced the gross weight to pounds, and subtracted the tare from it, which gave 962 pounds suttle. We then divided the suttle by 26, and subtracted the quotient from it, and obtained 925 pounds neat weight.

EXAMPLES FOR PRACTICE.

1. What is the neat weight of 120cwt. 2qr. gross, tare 176lb., tret 4lb. per 104lb.? *Ans.* 114cwt. 1qr. 12lb.

2. What is the neat weight of 27 bags of coffee, each 2cwt. 3qr. 17lb. gross, tare 13lbs. per cwt., tret 4lb. per cwt.? *Ans.* 66cwt. 2qr. 11lb.+

3. Sold 20 chests of tea, each 2qr. 25lb. gross, tare per cwt. 6lb., tret 4lb. per 104lb.?

4. What is the neat weight of 3hhds. of tobacco, each weighing 9cwt. 1qr. 20lb. gross., tare per cwt. 3qr. 10lb., tret 4lb. per 104lb.; and what is the value thereof, at 14 cents per pound?

+

SECTION XXXI

PERCENTAGE

ART. **125.** PERCENTAGE and *per cent.* are terms derived from the Latin words *per* and *centum*, which signify *by the hundred.*

QUESTIONS.—Art. 125. From what is percentage derived? What does it mean?

100)3,00
.03!

Percentage, or *per cent.*, therefore, means any rate or sum on a hundred. Thus, if I buy an article for $100, and sell it for $106, the gain is 6 *per cent.*, because the $6 were gained on the $100.

Again, if I buy an article for $1, and sell it for 95 cents, the loss is said to be 5 per cent.

, 95

ART. **126.** Since per cent. signifies any rate of ~~a hundred~~, or any number of hundredths, it may be written in the same manner as hundredths in decimal fractions. Thus, 6 per cent., 5 per cent., &c., may be written, .06, .05. And to reduce any given rate per cent. to a decimal fraction, we have the following

RULE.

Add ciphers to the given rate per cent., and divide it by 100; *the quotient will be the answer.*

100)6,00

Ex. Reduce 6 per cent. to a decimal fraction? ~~*Ans.* .06.~~

OPERATION.

100)6.00
———
.06 *Ans.*

It will be observed, that in this example, we added ciphers to the 6, and then divided by 100. Hence we obtained .06, six hundredths, as the decimal expression for 6 per cent. See ART. 76.

EXAMPLES FOR PRACTICE.

100)3.00

1. What is the decimal fraction for 5 per cent.? *Ans.* .05.
2. What is the decimal expression for 2 per cent.? *Ans* .02.
3. What is the decimal for 3 per cent.? *Ans.* .03.
4. What is the decimal for 4 per cent.? *Ans.* .04.
5. What is the decimal for 7 per cent.? *Ans.* .07.
6. What is the decimal for 12 per cent.? *Ans.* .12.
7. What is the decimal for 25 per cent.? *Ans.* .25
8. Reduce 4½ per cent. to a decimal. *Ans.* .045.
9. Reduce 6¼ per cent. to a decimal. *Ans.* .0625
10. Reduce 5¾ per cent. to a decimal. *Ans.* .0575

QUESTIONS.—Art. 126. How may per cent. be written? What is the rule for reducing per cent. to a decimal?

100)4,50

04

Art. 127. To find the percentage on any sum, or quantity.

RULE.

Multiply the given sum, or quantity by the rate per cent. considered as a decimal, and point off the product according to the rule for multiplication of decimals.

Ex. Bought a house for $825, and sold it for 6 per cent. gain; what did I gain on the transaction?

OPERATION.	
Sum	$825
Rate per cent.	.06
Gain	$49.50

In this example, we multiplied the given sum by the rate per cent. and pointed off in the quotient two places for decimals. Hence, we obtained $49.50 as the gain, or per cent.

Examples for Practice.

1. What is 2 per cent. of $325? *Ans.* $6.50.
2. What is 3 per cent. of $500? *Ans.* $15.00.
3. What is 2½ per cent. of $800? *Ans.* $20.00.
4. What is 9 per cent. of $75? *Ans.* $6.75.
5. What is 6¼ per cent. of $400? *Ans.* $25.00.
6. Bought one hogshead of sugar weighing 1008lbs. and sold it at a gain of ½ per cent. per lb.; what did I gain on the whole? *Ans.* $5.04.
7. I lost 10 per cent. on $650; how much have I remaining? *Ans.* $585.
8. A man bought 340 bushels of oats, but by accident lost 15 per cent. of the whole; how many bushels, had he remaining? *Ans.* 289bu.
9. Bought 20 shares of the Baltimore and Ohio Railroad, at $100; and sold them again at 9 per cent. advance; what did I gain by the operation? *Ans.* $180
10. Bought 35 acres of land, at $50 per acre, but finding it a bad bargain, I am willing to sell it at a loss of 12 per cent.; what will I loose? *Ans.* $210

Question.—Art. 127. What is the rule for finding the per cent. on any sum?

Mary Teresa Colem

I will [illegible] Jan 11 7

SECTION XXXII

SIMPLE INTEREST.

Art. 128. Interest is an allowance or compensation which the borrower of money makes to the lender. In computing interest, we have to consider the *Principal*, the *Rate* per cent., and the *Amount*. The *Principal* is the money on which interest is paid.

The Rate per cent. is the sum paid for the use of $100, 100cts., or 100£., for one year.

The *Amount* is the interest and principal added together.

Note.—*Legal interest* is the rate per cent. established by law. *Usury* is a higher rate of interest than is allowed by law.

The legal rate of interest varies in different States, and in different countries.

The legal interest in New York, Michigan, Wisconsin, Iowa, and South Carolina, is at 7 per cent.

In Georgia, Alabama, Mississippi, Texas, and Florida, at 8 per cent. In Louisiana, at 5 per cent.; and in all the other States, at 6 per cent.

The legal interest in Canada, Nova Scotia, and in Ireland, is at 6 per cent.; and in England, and France, at 5 per cent.

Thirty days is generally regarded as a month in calculating interest.

CASE I.

Art. 129. To find the interest for any given sum for one year, we have the following

RULE.

I. *Multiply the principal by the rate per cent., and divide the product by* 100. *The quotient will be the interest for one year.*

II. *When the number of years exceeds one, multiply the interest for one year by the number of years.*

Note.—When the principal consists of dollars *only*, multiply by the *rate per cent.*, and point off two figures on the right hand for cents. And when the principal consists of dollars and cents, multiply as before, and point off four figures on the right hand for cents and mills.

Questions.—Art. 128. What is interest? What is the principal? The rate per cent.? The amount? What is *legal* interest? Usury? What is the legal interest in the different States?—Art. 129. What is the rule to find the interest, &c.?

And when the principal consists of dollars, cents and mills, multiply as before, and point off five figures on the right hand for cents and mills.

Ex. Let it be required to find the interest on $500, for one year at 6 per cent.

OPERATION.

$5 0 0 Principal.
6 Rate per cent.
$3 0.0 0

In this example, we multiplied the principal $500 by 6, the rate per cent. and divided the product by 100, or pointed off two figures to the right, which is the same.

EXAMPLES FOR PRACTICE.

1. What is the interest on $500, at 5 per cent. for one year? *Ans.* $25.
2. What is the interest on $197, at 6 per cent. for one year? *Ans.* $11.82.
3. What is the interest on $126.25, at 6 per cent. for one year? *Ans.* $7.57,5
4. What is the interest on $87.87,5, for one year, at 6 per cent.? *Ans.* $5.27,25.
5. What is the interest on $976, for two years, at 6 per cent.? *Ans.* $117.12
6. What is the interest on $785.50, for 5 years, at 7 per cent.? *Ans.* $274.92,5.
7. What is the interest on $375.75, for 9 years, at 8 per cent.? *Ans.* $270.54.
8. What is the amount of $200, for one year, at 6 per cent.? *Ans.* $212.
9. What is the amount of $785.50, for 3 years, at 6 per cent.? *Ans.* $926.89.
10. What is the interest on 300£., for 1 year, at 6 per ct.? *Ans.* 18£.
11. What is the interest on 750£ 10s. for 1 year, at 5 per cent.? *Ans.* 37£. 10s. 6d.
12. What will be the amount of 560£. for 2 years, at 5 per cent.? *Ans.* 616£.

QUESTIONS.—When the principal consists of dollars only, what do you do? And when it consists of dollars, cents, and mills?

13 Require the amount of $87.96 for 7 years, at 4 per ct.?
Ans. $112.58,88.

14. A man put $1165 on interest for 5 years, at 4 per ct., what amount did he receive at the end of that time?
Ans. $1,398.

15. What is the amount of 35£. 5s. 6d. for 3 years, at 6 per cent.?

16. What will be the amount of a judgment of $31.75 for 1 year, at 6 per cent.?

CASE II.

ART. **130.** To find the interest for any number of months at 6 per cent.

NOTE 1.—If the interest be at 6 per cent., it is obvious that the interest for *one month* will be *one-half* per cent., that on the principal for every *two months* will be *one* per cent. Then to find the interest for months we have the following

RULE.

Multiply the principal by half the number of months, and divide the product by 100.

NOTE 2.—If the principal consists of dollars and cents, after multiplying by half the number of months, point off four figures on the right hand of the product; then the figures on the left hand of the point will be dollars, and the first two on the left of the point will be cents; the third figure mills, and the others, if any, the decimal part of a mill. If there be mills in the principal, point off five figures.

Ex. Let it be required to find the interest on $195 for 4 months, at 6 per cent.?

OPERATION.

$195
2 half number of months.
——
$3.90

In the example, we multiplied the principal by 2, half the number of months, and pointed off two figures on the right hand of the product, which is the same as dividing by 100. Hence $3.90 is the interest.

QUESTIONS.—Art. 130. What is the rule for finding interest for any number of months at 6 per cent.? What is observed in *Note* 2nd.

EXAMPLES FOR PRACTICE.

1. What is the interest on $587 for 6 months, at 6 per cent.? *Ans.* $17.61.
2. What is the interest on $325 for 8 months, at 6 per cent.? *Ans.* $13.00.
3. What is the interest on $192 for 10 months, at 6 per cent.? *Ans.* $9.60.
4. What is the interest on $78.75 for 5 months, at 6 per cent.? *Ans.* $1.96,8.
5. What is the amount of $98.50 for 7 months, at 6 per cent.? *Ans.* $101.94.
6. What is the amount of $785.12,5 for 3 months, at 6 per cent.? *Ans.* $796.90,18+.
7. What is the interest on 85£. for 9 months, at 6 per cent.? *Ans.* 3£. 16s. 6d.
8. What is the amount of 195£. 10s. for 4 months, at 6 per cent.? *Ans.* 199£. 8s. 2¼d.

NOTE.—If the time consists of years and months:—*Reduce the years to months, then work by the foregoing rule.*

Ex. What is the interest of $500 for 1 year and 8 months, at 6 per cent.?

y. mo. mo. mo.
1 = 12 + 8 = 20 ÷ 2 = 10 half number of months.
$500 × 10 = $50.00. *Ans.*

10. What is the interest on $165 for 3 years and 4 months, at 6 per cent.? *Ans.* $33.
11. What is the interest on $675.50 for 4 years and 2 months, at 6 per cent.? *Ans.* $168.87,5.
12 What is the interest on $35.85 for 2 years and 9 months, at 6 per cent.? *Ans.* $5.91,5.
13. What is the amount of $99.99 for 5 years and 6 mos., at 6 per cent.? *Ans.* $132.98,6
14. What is the interest on $3.50 for 1 year and 11 mos., at 6 per cent.? *Ans.* $0.40¼
15. What is the interest on 75£. for 2 years and 4 mos at 6 per cent.? *Ans.* 10£. 10s

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QUESTION.—If the time consists of years and months, what should be done?

CASE III.

Art. 131. To find the interest for any number of days.

RULE.

Find the interest on the principal for one year, and divide it by 365, the quotient will be the interest for one day; then multiply the quotient by the number of days, and the product will be the interest required.

Examples for Practice.

Ex. 1. What is the interest of $500, for 20 days, at 5 and at 6 per cent.?

```
       OPERATION.                          OPERATION.
    $500                                $500
       5                                   6
    -----     cts.    days.             -----      cts.
365)25.00(.6,849×20=               365)30.00(.8,219×20=
    2190      $1.36,98                 2920      $1.64,38
    ----                               ----
     3170                               800
     2920                               730
     ----                               ---
      1800                               700
      1460                               365
      ----                               ----
       3400                              3350
       3285                              3285
```

2. What is the interest on $5000, for 25 days, at 6 per cent.? *Ans.* $20.833+

3. What is the interest on $300, for 10 days, at 5 per cent.? *Ans.* $0.41,6.

4. What is the interest on $750.50, for 15 days, at 6 per cent.? *Ans.* $1.87+

5. What is the interest on $1200, for 27 days, at 7 per cent.? *Ans.*

CASE IV.

Art. 132. To find the interest for any number of days, by the following Table:

Table showing the number of days from any given day in one month to any given day in another month.

MONTHS.	JAN.	FEB.	MAR	APR	MAY	JUN.	JUL.	AUG	SEPT	OCT.	NOV	DEC.
JAN'Y...	365	31	59	90	120	151	181	212	243	273	304	334
FEB'Y...	334	365	28	59	89	120	150	181	212	242	273	303
MARCH..	306	337	365	31	61	92	122	153	184	214	245	275
APRIL...	275	306	334	365	30	61	91	122	153	183	214	244
MAY	245	276	304	335	365	31	61	92	123	153	184	214
JUNE....	214	245	273	304	334	365	30	61	92	122	153	183
JULY....	184	215	243	274	304	335	365	31	62	92	123	153
AUGUST	153	184	212	243	273	304	334	365	31	61	92	122
SEPT'R..	122	153	181	212	242	273	303	334	365	30	61	91
OCTOBER	92	123	151	182	212	243	273	304	335	365	31	61
NOV'R ..	61	92	120	151	181	212	242	273	304	334	365	30
DEC'R...	31	62	90	121	151	182	212	243	274	304	335	365

RULE

FOR FINDING THE NUMBER OF DAYS BETWEEN ANY GIVEN PERIODS BY THE ABOVE TABLE.

Find the first given month on the horizontal line in the left hand column, and the second given month in the line at the top of the table, and to the number of days found at the intersection of the two lines, add the difference between the days mentioned in the two given months.

What is the rule for finding the number of days between given periods by the above Table?

NOTE.—It must be observed, however, that when the number of days given in the *first* mentioned month is greater than the given number of days in the *second* month, then the difference of the days must be *subtracted* from the number found at the intersection of the lines. *See second example.*

When February has 29 days, proper allowance must be made.

1. Ex. How many days from March 21st to the 23d of the next September?

> 184, the number of days at the intersection of the lines, and 23 — 21 = 2, the difference of the days in the two given months. Hence 184d. + 2d. = 186d., *Ans.*

2. Ex. *under the note.* How many days from the 22d of December to the 21st of the next June?

> 182, number of days at the intersection of the lines, and 22 — 21 = 1, the difference of the days of the given months. Hence 182d. — 1d. = 181d., *Ans*

EXAMPLES FOR PRACTICE.

1. How many days from June 21st to the 22d of December; and what will be the interest on $750 at 6 per cent. for that time? *Ans.* 184 days. $23. int.

2. How many days between the 4th of July and the 25th of December; and what will be the interest, at 7 per cent. on $87.50 for that time? *Ans.* 174 days. $2.96 + int.

3. How many days from November the 6th to the 15th of April next; and what interest will I receive on a note for $145, at 6 per cent., at the expiration of that time? *Ans.* 160 days. $3.866+ int.

4- How many days from March 21st to the 19th of June next; and what amount will I receive for my note of $500 for that time, bearing interest at 6 per cent.? *Ans.* 90 days. $507.50.

What is the rule laid down in the note?

5. What is the interest on $875, for 5 months, 21 days, at 6 per cent.? *Ans.* $24.93,7

6. What is the interest on $11423.90, for 3 years, 4 months, 25 days, at 6 per cent.? *Ans.* $2332.379.

7. What is the interest on $40.75, for 9 months and 14 days, at 6 per cent.? *Ans.* $1.92,38+

8. A man holds a note for $99.50, payable in 3 months and 15 days, with interest; what sum will he receive at the expiration of that time? *Ans.* $101.24,12.

9. A merchant sold coffee to the amount of $5420. and received $1000 cash, and the balance in three equal notes, at three, six and nine months, with interest at 6 per cent.; what amount of interest did he receive on each note, and what was the whole interest? *Ans.* $22.10 on 1st note; $44.20 on 2d; $66.30 on 3d; whole amount $132.60.

CASE V.

ART. 133. To compute the interest between different dates.

RULE.

Subtract the less date from the greater, reckoning 30 *days to the month, and* 12 *months to the year; the remainder will be the time for which interest is required: then proceed according to the foregoing rules.*

Ex. What is the interest on $300, from July 20, 1847, to January 5, 1849, at 6 per cent.? *Ans.* $26.25.

OPERATION.

	yrs.	mo.	da.
	1849	1	5
	1847	7	20
Time	1	5	15

		$300	principal.
		6	
4	$\frac{1}{3}$	18.00	interest for 1 year
1	$\frac{1}{4}$	6.00	interest for 5 months.
15	$\frac{1}{2}$	1.50	
		.75	interest for 15 days.
		$26.25	*Ans.*

EXAMPLE FOR PRACTICE.

1. What is the interest on $500, from January 10, 1845, to April 15, 1847, at 6 per cent.? *Ans.* $67.91⅔.

QUESTION.—Art 133. What is the rule to compute interest between different dates?

CASE VI.

Art. 134. When the principal, rate per cent. and amount are given to find the time.

RULE.

As the interest of the principal for one year, is to whole interest, so is one year to the time required.

Ex. In what time will $325 amount to $500.50, at 6 per cent.?

OPERATION.

$325	Amount	$500.50
6	Principal	325.00
$19.50 interest for 1 year.	Interest	175.50

As 19.50 : $175.50 :: 1y : 9 years. *Ans.*

Note.—Money on simple interest will double itself in 16 years and 8 months, at 6 per cent.

Examples for Practice.

1. In what time will $400 amount to $500, at 6 per ct.? *Ans.* 4yrs., 2mo.

2. In what time will $340.50 amount to $380 at 6 per cent.? *Ans.* 1 year, 11mo. 6 days.

3. In what time will $600 amount to $800, at 5 per cent.? *Ans.* 6yrs. 8 months.

4. In what time will $150 amount to $200, at 7 per cent.; *Ans.* 4yr. 9mo. 4$\frac{2}{7}$ days.

5. In what time will $100 double itself at 6 per cent., 5 per cent. and at 7 per cent.? *Ans.* 16y. 8mo. at 6 per ct., 20y. at 5 per ct., 14y. 3$\frac{3}{7}$mo. at 7 per ct.?

CASE VII.

Art. 135. When the amount, time, and rate per cent are given to find the principal.

Questions.—Art. 134. What is the rule to find the time, when the principal, &c. are given?—Art. 135. What is the rule to find the principal, when the amount, &c. are given?

RULE.

Multiply the time and the rate per cent. together, and add $100 *to the product, then say, as this amount, is to the amount given, so is* $100 *to the principal required.*

Ex. What principal will amount to $500 in 3 years, at 6 per cent.?

OPERATION.

$$3 \times 6 = 18 \text{ product of rate and time.}$$
$$\underline{100} \text{ added.}$$
$$118 \text{ amount.}$$

Then $118 : $500 :: $100 : $423.72,3.

EXAMPLES FOR PRACTICE.

1. What principal will amount to $965.57,5 in 5 years, at 6 per cent.? *Ans.* $742.75.
2. What principal will amount to $750 in 4 years, at 6 per cent.? *Ans.* $604.83,8 +.
3. What principal will amount to $100 in 16 years and 8 months, at 6 per cent.? *Ans.* $50.
4. What principal will amount to $1,525 in 7 years and 6 months, at 5 per cent.? *Ans.* $ 1109,09 +.

CASE VIII.

ART. **136.** When the principal, amount, and time are given, to find the rate per cent.

RULE.

As the product of the time and principal, is to the interest of the whole time, so is $100, *to the rate per cent. Or, divide the interest by the product of the time and principal, and the quotient will be the rate per cent.*

Ex. At what rate per cent. will $500 amount to $725, in 9 years?

QUESTION.—Art. 136. What is the rule to find the rate per cent, when the principal, &c. are given?

OPERATION.

Principal $500 $725 Amount.
Time 9 500

Product 4500 : 225 Interest :: $100 : 5
100

4500)22500(5 per cent.
22500

Or $225 ÷ (500 × 9) = .05 per cent.

EXAMPLES FOR PRACTICE.

1. At what rate per cent. will $837 amount to $1029.51, in 4 years? *Ans.* 5¾ per cent.

2. At what rate per cent. will $742.75 amount to $965.57,5, in 5 years? *Ans.* 6 per cent.

3. At what rate per cent. will $600 amount to $856.50, in 9 years and 6 months? *Ans.* 4½ per cent.

4. At what rate per cent. will $701 amount to $806.15 in 2.5 years? *Ans.* 6 per cent

SECTION XXXIII.

PARTIAL PAYMENTS.

ART. **137.** PARTIAL PAYMENTS are payments, or endorsements made at different times, of a part of a note, or other obligation.

ART. **138.** In the United States court, and most of the courts of the several States, the following rule has been adopted for computing interest on notes, bonds, &c., when partial payments have been made.

RULE.

I. *Compute the interest on the first principal, from the time when the interest commenced, to the time when the first payment*

QUESTIONS.—Art. 137. What are partial payments?—Art. 138. In the United States court, &c. what is the rule for computing interest when partial payments are made?

was made, and if the payment exceed this interest, add the interest to the principal, and from the sum, subtract the payment made at that time, together with the preceding payments, if any; and the remainder forms new principal.

II. *But if any payment should be less than the interest, do not add the interest to the principal, until other payments are made, which added together will exceed the interest computed to the time of the last payment: then add the interest, so computed, to the principal, and from the sum, subtract the sum of the payments. The remainder will form a new principal on which interest is to be computed as before; and proceed in the same manner to the time of final settlement.*

Ex. $365.50. *Baltimore*, Jan. 1st., 1844.

For value received, I promise to pay Henry Davis, or order, three hundred and sixty-five dollars and fifty-cents, with interest. J. W. Bond.

Attest, Daniel Jones.

On this note are the following payments:—

June 10, 1844, received fifty-dollars.
Dec. 8, 1844, received thirty dollars.
Sept. 25, 1845, received sixty dollars.
July 4, 1846, received ninety dollars.
Aug. 1, 1847, received ten dollars.
Dec. 2, 1847, received one hundred dollars.

What will remain due January 7, 1849?

OPERATION.

Principal bearing interest from Jan. 1, 1844, to June 10, 1844,	$365.50
Interest from Jan. 1, 1844, to June 10, 1844, 5mo. 9d.	9.68
Amount,	375.18
First payment, June 10, 1844,	50.00
Balance for new principal,	$325.18
Interest from June 10, 1844, to December 8, 1844, 5mo. 28d.	9.64

QUESTION.—Art. 138. Explain the example.

Amount,		334.82
Second payment, December 8, 1844,		30.00
Balance for new principal,		$304.82
Interest from Dec. 8, 1844, to Sept. 25, 1845, 9mo. 17d.		14.58
Amount,		319.40
Third payment, Sept. 25, 1845,		60.00
Balance for new principal,		$259.40
Interest from Sept. 25, 1845, to July 4, 1846, 9mo. 9d.		12.06
Amount,		271.46
Fourth payment, July 4, 1846,		90.00
Balance for new principal,		$181.46
Interest from July 4, 1846, to Dec. 2, 1847, 16mo. 28d.		15.36
Amount,		196.82
Fifth payment, Aug. 1, 1847, (a sum less than the interest,)	$10.00	
Sixth payment, Dec. 2, 1847,	100.00	
		110.00
Balance for new principal,		$86.82
Interest from Dec. 2, 1847, to Jan. 7, 1849, 13mo. 5d.		$5.71
The amount that remains due, Jan. 7, 1849,		$92.53

Examples for Practice

1. $867.33. *Baltimore*, Jan. 6, 1840.

For value received, I promise to pay Samuel Smith, or order, eight hundred and sixty-seven dollars, and thirty-three cents, with interest. John R. Tyler.

On this note are the following endorsements:—

April 16, 1843, received $136.44.
April 16, 1845, received $319.00.
Jan. 1 1846, received $518.68.

What will remain due, July 11, 1847? *Ans.* $215.10,3

2 $960.00. *Baltimore*, Oct. 23, 1841.

For value received, I promise to pay Henry Hyland, or order, nine hundred and sixty dollars, with interest at seven per cent. Edgar Hurtt.

Attest, Isaac Nicholson.

On this note are the following endorsements:—

Sept. 25, 1842, received one hundred and forty dollars.
July 7, 1843, received eighty dollars.
Dec. 9, 1843, received seventy dollars.
Nov. 8, 1844, received one hundred dollars.

What remains due Oct. 23, 1845? *Ans*. $770.39.

3. $300.00. *New York*, Jan. 1, 1845.

For value received, I promise to pay Wm. H. Cole, or order, three hundred dollars, with interest.

Attest, Francis Gibbins. James Williamson.

On this note the following endorsements were made:—

Sept. 1, 1845, received eighty dollars.
July 1, 1846, received one hundred dollars.
April 1847, received fifty dollars.

What sum was due Jan. 1, 1849? *Ans*. $110.56+.

SECTION XXXIV.

COMPOUND INTEREST.

ART. 139. COMPOUND INTEREST is that interest, which arises from the principal and interest added together. For example, the *simple interest* on $1000 for one year, is $60: now if this interest be added to the principal, we will have $1060, the principal for the second year; and the interest thereon will be $61.80, this latter is called a *compound interest*. For computing compound interest, we have the following

---

QUESTION.—Art. 139. What is compound interest?

RULE.

I. *Find the interest on the principal for the first year, and add it to the principal, and this amount will be the principal for the second year. Find the interest on this second principal and add as before; and the amount will be the principal for the third year: and so continue through the whole number of years.*

II. *Subtract the first principal from the whole amount, and the remainder will be the compound interest.*

Ex. What is the compound interest on $1000 for 3 years at 6 per cent.

OPERATION.

```
   $1000
       6
   ------
    60.00 interest for the first year.
  1000
  ------
  1060 amount, principal for second year.
     6
  ------
    63.60 interest for the second year.
  1060
  ------
  1123.60 second amount, principal for third year.
       6
  ------
    67.4160
  1123.60
  ------
  1191.01,60 third amount.
  1000.      first principal deducted.
  ------
 $191.01,6 the compound interest for three years.
```

Examples for Practice.

1. What is the compound interest on $256, for 3 years, at 6 per cent.? *Ans.* $48.89,9

Questions.—Art. 139. What is the rule? Explain the example.

2. What is the compound interest on $295.37, at 6 per cent. for 2 years? *Ans.* $36.50 +.

3. What will be the compound interest on $3750, for 4 years, at 7 per cent.? *Ans.* $1165.48 +

4. What will be the compound interest on $100 for 3 years, at 6 per cent.? *Ans.* $19.101 +.

5. What will be the difference between the *simple* and compound interest on $3700 for 5 years. *Ans.* $1110 simp. inst., $1251.434+ comp. inst., $141.434+ difference.

COMMISSION AND BROKERAGE.

Art. **140.** Commission is an allowance of so much per cent. made to factors or merchants for buying or selling goods.

Brokerage is an allowance of a certain per cent. to a person called a *Broker*, for assisting merchants or factors in buying or selling goods.

For calculating commission and brokerage, we have the following

RULE.

Multiply the sum by the rate per cent. and divide the product by 100; *the quotient will be the answer.*

Examples for Practice.

1. What will the commission on $1000 come to, at 2½ per cent.? $1000 × 2.5 = $25. *Ans.*

2. A merchant sold 60 barrels of flour, at $5.50 per barrel; what will his commission be on the whole, at 2½ per ct.? *Ans.* $8.25.

3. A factor sold 300 bales of cotton, at $395 per bale, at 1¾ per cent. on the whole price; what will his commission be? *Ans.* $20.73,7.

4. A property agent sold a house for $1300, what will be his commission, at 2¼ per cent.? *Ans.* $29.25.

5. A broker sold goods to the amount of $750.50; what will his brokerage be, at 2¼ per cent.? *Ans.* $16.51,1.

Questions.—Art. 140. What is commission and brokerage? What is the rule?

6. A factor received $1000 to lay out; how much will be his commission, at 4 per cent.? *Ans.* $40.

7. What will the brokerage be on $1492, at 1¾ per cent.? *Ans.* $26.11.

8. A merchant sold 9425 pounds of pork, for 5 cents per pound; what will his commission be, at 2½ per cent.? *Ans.* $11.78,1.

9. A factor purchased for his principal 10 shares in the Baltimore and Ohio Railroad, at $112.25 per share; what is the factor's commission, at ¾ per cent.? *Ans.* $8.41,8+.

10. My agent in London purchased goods for me, to the amount of 879£. 12s. 9d.; what will be his commission, at 3⅜ per cent.? *Ans.* 29£. 13s. 9d.

SECTION XXXV.

BANKING.

Art. **141.** A bank is an incorporated institution, established for the purpose of loaning money and dealing in exchange.

Its capital is owned in shares by individuals, called *stockholders*.

It has a deposite of specie, and is permitted by law to issue *notes*, called bank bills, which are used for a circulating medium as money.

When a bank loans money, it is generally customary to deduct from the amount of the note, the simple interest of the money, for the time it is lent. A note is then said to be *discounted*.

When a note is presented to a bank for discount, the interest is computed not only for the specified time; but for *three* days after the expiration of the time, called *days of grace*.

Thus, if a note, payable in 60 days, be presented to a bank to be discounted, the interest or discount is computed for 63 days.

Questions.—Art. 141. What is a bank? What is said of its capital? What has it, and what is allowed? When a bank loans money, what is customary? When a note is presented for discount, what is done?

Art. 142. For computing bank discount, we have the following

RULE.

I. *Find the interest on the given sum, for the given time and rate, including* THREE *days of grace, and the interest will be the* DISCOUNT.

II. *Deduct the discount from the given sum, the remainder will be the present worth.*

Note.—Banks usually discount at the rate per cent. allowed by the laws of their respective States.

Examples for Practice.

1. What will be the bank discount on $478, for 60 days at 6 per cent.?

OPERATION.

$478

$4.78 interest for 60 days, found by rule under Art. 130
.23,85 interest for three days' grace

$5.01,85 discount.

2. What is the bank discount on $780, for 30 days, at 6 per cent.? *Ans.* $4.29.

3. What will be the discount on $900, for 90 days, at 6 per cent.? *Ans.* $13.95.

4. What will be the bank discount on my note for $195, for 6 months, at 7 per cent.? *Ans.* $6.93,87.

5. How much money should I receive on a note for $1000, payable at 4 months, discounted at 6 per cent.? *Ans.* $979.50.

6. A merchant received a note for the sale of goods, for $342.16, payable in 3 months. How much money should he receive for it at bank, and what is the discount, at 6 per cent.? *Ans.* $336.85,6+ amt. rec'd; $5.30,3 discount.

Question.—Art. 142. What is the rule for computing discount?

SECTION XXXVI.

DISCOUNT.

Art. **143.** Discount is an allowance made for the payment of money before it becomes due.

The *present worth* of any sum is the principal, that must be put at interest to amount to that sum in a given time. Thus, $100 is the *present worth* of $106, due one year hence; because $100, at 6 per cent., will amount to $106; therefore $6 is the *discount;* and this being deducted, will leave $100 for the present worth.

Art. **144.** To find the present worth, and discount of any sum for a given time, we have the following

RULE.

I. *Divide the given sum by the amount of* 1 *dollar for the time, and the quotient will be the present worth.*

II. *Subtract the present worth from the given sum, and the remainder will be the discount.*

Note.—The discount on any sum of money is a fraction *less* than the interest on the sum for the same time. Thus, the discount on $106 for one year is $6; but the interest on the same is $6.36.

Ex. What is the present worth and discount of $12.72, due one year hence, at 6 per cent.?

OPERATION.	OPERATION.
1.06) $12.72 ($12 present worth.	$12.72
106	12.00
212	$ 0.72 discount.
212	

As one dollar, in one year, will amount to one dollar and six cents, we therefore divided the given sum by $1.06, and obtained $12 for the present worth. This subtracted from the given sum, gives $0.72 for the discount.

Questions.—Art. 143. What is discount? The present worth?—Art 144. What is the rule? Explain the example.

EXAMPLES FOR PRACTICE.

1. What is the present worth of $1828.75, due in one year, at 4½ per cent.? *Ans.* $1,750.

2. What is the present worth of $1290.81, discounted at 4 months? at 6 per. cent. *Ans.* $1265.50.

3. A gave two notes to B, the first for $150, for three months, and the second for $200 for six months: What is the present worth of his notes, discounted at 6 per cent.?
Ans. first $147.78,5, second $194.17,4.

4. What is the discount of my note for $180, at 3 months at 7 per cent.? *Ans.* $3.09,6.

5. What is the present worth of $580.25, due in 4½ months, at 5 per cent.? *Ans.* $569.57.

6. Bought goods to the amount of $800, payable as follows: $400 in 6 months and $400 in 9 months; what is the present worth, discounted at 6 per cent.? *Ans.* 771.124.

7. What is the discount on $1586.50 due in 1 year and 4 months, at 6 per cent.? *Ans.* 117.519.

8. A man bought a house for $1800, and agrees to give $900 cash, and the balance in two equal payments at 9, and 12 months. What is the present worth of the balance, discounted at 7 per cent.? *Ans.* $848.113.

9. I hold A's note for $90, due in 60 days, but he is willing to pay it at present, at a discount of 7 per cent.: how much will I receive for it? *Ans.* $88.962+.

10. I have given my note for $1000, payable December 18, 1849; what is the note worth June 7, 1848?
Ans. $908.166+.

11. What is the difference between the interest on $1060, for 2 years, at 6 per cent., and the discount on the same amount, for the same time, at 6 per cent.?

12. I hold a note for $250, due in 90 days; what is its present worth, discounted at 12½ per cent., and how much will I lose at that rate?

INSURANCE.

Art. 145. **Insurance** is an agreement entered into between the owners of property, goods, &c., and a company or individuals, who engage to make good the loss of ships, houses, goods, &c., which may happen by storms, fire or other accident.

The written instrument by which the contract is effected between the parties, is called the *Policy*.

The Premium is the amount paid by the owner of the goods, property, &c., and it is generally so much per cent. on the amount insured.

Note.—The insurance on houses and goods is generally for a year, but the insurance on ships and cargo, is usually for the voyage.

RULE.

Multiply the amount insured by the rate per cent., and divide the product by 100*; the quotient will be the premium to be paid.*

Examples for Practice.

1. What will be the premium for the insurance of a house valued at $800, at ½ per cent.?

$800 × ½ = $4.

2. What will be the premium for the insurance of goods, valued at $6500, at 3½ per cent.? *Ans.* $227.50.

3. What will be the premium for insuring a ship and cargo, valued at $75000, from Baltimore to San Francisco, at 2¾ per cent.? *Ans.* $2062.50

4. What will be the premium for insuring my furniture valued at $220, at 1½ per cent.? *Ans.* $3.30

5. What is the premium on $3675, at 4⅞ per cent.? *Ans.* $179.15+

6. If a policy be taken out for $600 at 10 per cent., what is the sum covered? *Ans.* $540

7. What sum will be secured for a policy of $1728, deducting 15 per cent.? *Ans.* $1468.80.

8. What is the premium for insuring a cotton factory, valued at $35000, at 12½ per cent.? *Ans.* $4375.

Questions.—Art. 145. What is insurance What is the policy? What is the premium? What is the rule?

SECTION XXXVII.

STOCK.

ART. 146. STOCK is a general name given to government funds, and to the *capital* of incorporated institutions, such as banks, railroad companies, &c.

It is customary to divide stock into a number of equal parts, called *shares*, which often vary in their value.

When stocks sell for their original value, they are said to be *at par;* when they sell for more than their original value, they are said to be *above par;* and when less than their original value, *below par.*

The premium, or advance, and discount on stocks, are generally computed at a certain per cent. on the original value of the shares.

ART. 147. To find the value of stocks, we have the following

RULE.

I. *When the value is above par, that is above* 100: *Multiply the given sum by the excess above par; divide the product by* 100, *and add the quotient to the given sum, the result will be the value of the stock.*

II. *When the value is below par: Multiply the given sum by the amount below par, divide the product by* 100, *and subtract the quotient from the given sum; the remainder will be the value of the stock.*

Ex. What is the value of $975 bank stock, at 5 per cent. above par? and at 5 per cent. below par?

OPERATION.

$975×5=$48.75	$975×5=$48.75
Value above par.	Value below par
975+48.75=$1023.75	975—48.75=$926.25

EXAMPLES FOR PRACTICE.

1 What is the value of $1000 bank stock, at 6 per cent. above par? *Ans.* $1060

2. What is the value of 15 shares, $100 each, of railroad stock, at 13 per cent. above par? *Ans.* $1695.

3. What sum will purchase $1789 of bank stock, at 9 per cent. below par? *Ans.* $1627.99

4. Sold $500 of bank stock, for 4½ per cent. above par; what sum did I gain? *Ans.* $22.50.

5. Sold $750 of rail road stock, at 5¼ per cent. below par; what sum did I lose? *Ans.* $

6. What is the value of 20 shares of bank stock, at 12½ per cent. discount; each share being $100? *Ans.* $1750

7. What is the value of $940, of Baltimore and Ohio Railroad stock, at 7½ per cent. above par? *Ans.* $

SECTION XXXVIII.

DUTIES.

Art. **148.** Duties are taxes imposed by government on imported goods. These duties are either *specific* or *ad valorem.*

A *specific duty* is a certain sum paid on a ton, hundred weight, yard, gallon, &c.

An *ad valorem* duty is a certain per cent. paid on the actual cost of the goods in the country from which they are imported.

Art. **149.** In calculating duties, there are certain allowances made, such as *draft, tare* and *leakage.*

Draft is an allowance for *waste,* made on the weight of goods.

Tare is an allowance made for the weight of the cask, box, &c., which contains the goods.

Leakage is an allowance of 2 per cent. for waste, made on liquors.

Gross weight is the weight of the goods, together with the cask, box, bag, &c.

Net weight is that which remains after all allowances have been made.

Questions.—Art. 148. What are duties? What is a specific duty An ad valorem duty?—Art. 149. What is draft? Tare? Leakage Gross weight? Net weight?

Art. 150. Allowance for Draft.—The following allowance is made in weighing goods:

On	112	pounds,	an allowance of			1 pound.
Above	112	"	and not exceeding	224	pounds,	2 pounds
"	224	"	" "	336	"	3 "
"	336	"	" "	1120	"	4 "
"	1120	"	" "	2016	"	7 "
"	2016	"				9 "

Note.—Draft and leakage are always the same, and must be deducted from each bag, box, cask, &c. It is not necessary to mention them in the question.

CASE I.

Art. 151. To find the specific duty on goods or merchandise.

RULE.

Deduct from the given quantity, all allowances to be made, and then multiply the remainder by the duty on a pound, hundred weight, ton, gallon, &c., of the given quantity, and the product divided by 100 *will be the duty required.*

Ex. What is the duty on 1 hogshead of sugar weighing 950lb. gross, at 2½ cents per pound; tare 10 per cent.

OPERATION.

Gross weight,	950lb.
Draft deducted,	4lb.
	946lb.
Tare	95lb. on 946lb. at 10 per ct.
Net weight,	851lb. × 2½ = $21.27,5.

Note.—In calculating the allowance for tare and leakage, a fraction equal to, or greater than *one-half*, is reckoned as *one whole unit*, when less than *one-half*, it is omitted.

Questions.—Art. 150. What allowance is made in weighing goods. Art. 151. What is the rule for finding the specific duty on goods? Explain the example.

EXAMPLES FOR PRACTICE.

1. What is the duty on 760 bags of coffee, each weighing 368lb. at 2 per ct. per pound; tare 12 per cent.? *Ans.* $

2. What is the duty on 2 pipes of Lisbon wine, gauging as follows: No. 1, 200 gallons; No. 2, 150 gallons; and duty at 25 per cent.? *Ans.* $87.50.

3. What is the duty at London, on 15 hogsheads Maryland tobacco, each weighing 1250lb. gross, tare 12 per cent., and at 3 per cent. per pound? *Ans.* $495.

4. What will be the duty on 20 bales of silk, each weighing 650lb. gross, at 40 cents per pound; tare 10 per cent.?

CASE II.

ART. **152.** To find the ad valorem duty on goods and merchandise.

RULE.

Find the whole value of the goods; then multiply that value by the rate per cent. and divide the product by 100; *the quotient will be the ad valorem duty.*

EXAMPLES FOR PRACTICE.

1. What will be the ad valorem duty on 200 yards of broadcloth, at $5 per yard, the duty 25 per cent.

OPERATION.

200 × $5 = $1000 × 25 = $250.00 duty.

2. What is the ad valorem duty on 2500lb. Russia hemp. at 6¼ cents per lb.; duty 20 per cent.? *Ans.* $31.25.

3. What will be the ad valorem duty on 20 tons of Russia iron, at $40 per ton; duty at 30 per cent.? *Ans.* $240.

4. What is the duty on 1728lb. of copper sheathing invoiced at $3200, at 20 per cent. ad valorem? *Ans.* $640.

5. What are the net weight and ad valorem duty, at 30 per cent. on 13 boxes of sugar, weighing 450 pounds each tare 15 per cent., and cost of the sugar being 8cts. per pound

Ans. 4972.5lbs. net; $119.340 duty

SECTION XXXIX.

ASSESSMENT OF TAXES.

ART. 153. A TAX is an annual duty levied on the property of individuals, for the support of the government.

Taxes are usually collected from each individual, in proportion to the amount of his property.

In some States, however, there is a certain tax, called a *poll-tax*, imposed upon every white male citizen, above the age of twenty-one.

NOTE.—The term poll, is a Saxon word, signifying a *head*. A tax on the income or the property of an individual, is called a *Direct Tax*; and a tax on the articles for which the income, or property is expended, is called an *Indirect Tax*.

ART. 154. To find the tax on a city, town, county, and the property of individuals, we have the following

RULE.

I. *First take an inventory of all the taxable property, real and personal, and also the number of polls, if any, liable to taxation. Then multiply the number of polls, by the sum assessed on each poll, and subtract this amount from the amount of taxes to be raised on the property of the city, town, or county.*

II. *Divide the remainder by the value of the property, and the quotient will be the tax on one dollar of each individual's real and personal estate.*

III. *Multiply the value of each man's property by the tax on one dollar, and the product will be the amount of the tax on his property.*

IV. *If there be a poll tax, it must be added to the tax upon his property, when the entire amount of his tax will be obtained.*

EX. The tax to be assessed on a certain village is $2200. The real and personal property of the village is valued at $90,000. There are 800 polls, each taxed $0.50. What is the tax on $1.00? And what is A's tax, whose real and personal property is valued at $3200; and who pays for 4 polls?

QUESTIONS.—Art. 153. What is a tax? How are taxes usually collected? What does the term mean? What is a direct tax? An indirect tax? Art. 154.—What is the rule for finding the tax on a city, &c.? Explain the example.

OPERATION.

$0.50 × 800 = $400, amount assessed on the polls.
$2200 — $400 = $1800, am't. to be assessed on the property
$1800 ÷ $90000 = $0.02, tax on $1.00. 1st. *Ans*
$3200 × $0.02 = $64.00, A's tax on real & personal prop'ty
$0.50 × 4 = $2, A's poll tax.
$64 + $2 = $66, amount of A's tax. 2nd. *Ans*

EXAMPLES FOR PRACTICE.

1. The town of V., is taxed to the amount of $220.52. The value of the property, real and personal, on which this tax is to be levied, is estimated at $10,000. There are 38 polls, each taxed $0.54, ;· what is the tax on $1.00, and what tax does a person pay, whose real and personal estate is estimated at $1200, and who pays 3 polls. *Ans.* $0.02 per dollar., and $25.62, the tax on his property.

2. What is A's tax, whose real estate is valued at $600, and his personal property at $1200 ; and who pays 6 polls ? *Ans.* $39.24.

3. What is the annual tax of A's real and personal estate, valued at $12,600, and at the same time pays 3 polls ? *Ans.* $253.62

SECTION XL.

REDUCTION OF CURRENCIES.

ART. **155.** Reduction of currencies is the method of finding the value, or the denomination of one currency in the denomination of another.

The nominal value of the dollar, expressed in shillings and pence, differs in the different States of the Union. The following table will exhibit the difference.

ART. **156.** TABLE.

In the New England States, Indiana, Illinois, Virginia, Missouri, Kentucky, Tennessee, Mississippi, Alabama, Flori-

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QUESTION.—Art. 155. What is reduction of currencies ?

da, and Texas, the value of the dollar is 6 shillings; $\$1=\frac{6}{20}$£. or $\frac{3}{10}$ of a pound.

In New York, Michigan, and Ohio, the dollar is valued at 8 shillings; $\$1=\frac{8}{20}$£. or $\frac{2}{5}$ of a pound.

In New Jersey, Pennsylvania, Maryland, and Delaware the dollar is valued at 7 shillings and 6 pence; $\$1=\frac{90}{240}$£. or $\frac{3}{8}$ of a pound.

In North Carolina, at 10 shillings; $\$1=\frac{10}{20}$£. or $\frac{1}{2}$ of a pound.

In South Carolina and Georgia, at 4 shillings and 8 pence; $\$1=\frac{56}{240}$£. or $\frac{7}{30}$ of a pound.

In Canada, and Nova Scotia, the dollar is valued at 5 shillings; $\$1=\frac{5}{20}$ £. or $\frac{1}{4}$ of a pound.

In English, or sterling money, the dollar is valued at 4 shillings 6 pence; $\$1=\frac{9}{40}$£.

Note.—Previous to the Act of Congress in the year 1792, which established the Federal money, throughout the United States, all calculations were made in pounds, shillings, pence and farthings, and one dollar was reckoned at 4s. 6d. sterling. The American dollar, it will be seen, has a different value in many of the States. The origin of this difference may be thus traced.

Under the Colonial Government, several of the States issued Bills of Credit, which were not received by the British merchants at their par value. Persons holding these bills, were obliged to pay a higher nominal amount, than they had to pay in sterling money.

Thus, in the New England States, 6 shillings passed for one dollar, or 4s. 6d. In New York, where the depreciation was greater, 8 shillings made a dollar. In South Carolina and Georgia, the dollar was valued at 4s. 8d ; and in the same manner, the difference occured in the other States.

CASE I.

Art. 157. To change any of the above currencies to Federal money.

RULE.

I. *When the given number consists of pounds only, divide the pounds by fractional parts of a pound, as found in the above table.*

II. *When the given number consists of shillings, pence, and*

Questions.—Art. 156. What is the value of the dollar in the different States? Previous to 1792, how were calculations made? What was the origin of the difference?—Art. 157. What is the rule for changing the above currencies to Federal money?

farthings, reduce the shillings, pence, and farthings to the decimal of a pound, and annex them to the pounds; then divide the sum by the fractional part of a pound as given in the table.

Ex. 1. Let it be required to reduce 15£. New England currency, to dollars and cents. *Ans.* $50

OPERATION.

$$15£. \div \tfrac{3}{10} = \$50.$$

Ex. 2. Let it be required to reduce 15£. 15s. 6d., Maryland currency, to dollars and cents. *Ans.* $42.06,6+

OPERATION.

$$15£.\quad 15s.\quad 6d. = 15.775£$$
$$15.775£ \div \tfrac{3}{8} = \$42.06,6+$$

Examples for Practice.

1. Reduce 144£. 7s. 6d., New England currency, to dollars and cents. *Ans.* $481.25.

2. Reduce 50£. New York currency, to Federal money. *Ans.* $125.00.

3. Reduce 129£. Pennsylvania currency, to United States money. *Ans.* $344.

4. Change 72£. 3s. 1d. 3qr. of old North Carolina currency, to United States money. *Ans.* $144.31 +.

5. Change 42£. South Carolina currency, to United States money. *Ans.* $180.

6. Reduce 144£. 4s. of Canada and Nova Scotia currency, to United States money. *Ans.* $576.80.

7. Reduce 6576£. English or Sterling money, to United States money. *Ans.* $29,226.66,6+.

8. Change 9£. 10s. old Maryland currency into Federal money. *Ans.* $25.33,3+

CASE II.

ART. **158.** To reduce United States money to pounds, shillings, and pence of the different currencies, named in the table.

RULE.

Multiply the dollars and cents by the numerator, and divide the product by the denominator of the fractional part of a pound, as exhibited in the foregoing table.

Ex. Let it be required to reduce $50, to pounds of New England currency. *Ans.* 15£

OPERATION.

$$\$50 \times \tfrac{3}{10} = 15£.$$

EXAMPLES FOR PRACTICE.

1. Change $42.06,6, to old Maryland currency. *Ans.* 15£. 15s. 6d.

2. Change $125, to New York currency. *Ans.* 50£.

3. Change $344, to Pennsylvania currency. *Ans.* 129£

4. Change $144.32,4, to North Carolina currency. *Ans.* 72£. 3s. 1¼d.

5. Reduce $576.80, to Canada currency. *Ans.* 144£. 4s.

6. Reduce $29,226.66,6, to English, or Sterling money. *Ans.* 6,575£. 19s. 11¾d.

7 Reduce $25.33,3, to old Maryland currency. *Ans.* 9£. 10s.

SECTION XLI.

EXCHANGE.

ART. **159.** Exchange is the act of paying or receiving the money of one country for its equivalent in the money of another country, by means of *Bills of Exchange.*

It comprehends in its operation, the reduction of money, and the negotiation of bills; and it also determines the comparative value of the currencies of all nations, shows how foreign debts are discharged, loans paid, &c., without the risk, or expense of transporting specie.

BILLS OF EXCHANGE

ART. **160.** A Bill of Exchange is a written order directed to a person at a distance, to pay a certain sum of money at

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QUESTIONS.—Art. 159. What is Exchange? What does it comprehend?—Art. 160. What is a bill of Exchange? How many persons are concerned in a bill of Exchange?

an appointed time. In mercantile transactions of this kind, there are generally four persons concerned, viz:

1. The *drawer*, who receives the value; sometimes called the *maker* of the bill.

2. The *drawee*, or the person, upon whom the bill is drawn; he is also called the acceptor, when he accepts the bill, which is an engagement to pay it.

3. The person who gives value for the bill, is called the *buyer* or *remitter*.

4. The person to whom it is ordered to be paid, is called the *payee*.

The payee may pass the bill to any person, by endorsement; and the person having it in his possession at any time, is called the *holder*.

When the holder of a bill disposes of it, he writes his name on the back, which is called *endorsing*. If the bill be endorsed in favor of any particular person, it is called a special endorsement, and the person to whom it is thus made payable, is called the *endorsee*, who must also endorse the bill if he negotiates it.

Any person may endorse a bill, but every endorser, as well as acceptor, is a security for the bill, and may therefore be sued for payment.

Bills of exchange are made payable, according to the agreement of the parties, or the custom of countries. Some bills are drawn at sight; others, at a certain number of days or months, after sight, or date.

Three days, called *days of grace*, are usually granted to the acceptor, after the term of the bill expires.

In calculating the time, when a bill, payable after date, becomes due, the day on which it is dated is not included; and if the bill be payable after *sight*, the day of presentment is not included. When the time is expressed in months, the calendar months are understood; and when the month is longer than the preceding one, it is a rule not to go into a third month.

Thus. if a bill be dated on the 28th. 29th. 30th or 31st of

QUESTIONS.—Art. 160. Who is the drawer? Drawee? Buyer, or remitter? Payee? What may the payee do? When the holder of a bill disposes of it, what does he do? How are bills of exchange made payable?

January, and payable one month after date, the term equally expires on the last day of February, to which the three days of grace must be added, and therefore it will become due on the 3d of March.

It is customary, as a precaution against accident, to draw three copies of a Foreign Bill, and to send them all by different conveyances. They are denominated the *First, Second* and *Third of Exchange;* and when one of them is paid, the rest become void.

Art. **161.** Form of a Bill of Exchange.

Baltimore, May 5th, 1849.

Exchange for 300£. sterling.

At ninety days' sight of this, my first Bill of Exchange, (the second and third of the same tenor and date unpaid,) pay to John Hartman, or order, three hundred pounds sterling, with or without further advice.

SAMUEL R. JOHNSON.

Messrs. Knox & Coleman,
Merchants, London.

When the exchange relates to remitting bills from one commercial place in the same country to another, the transaction is called *Inland Exchange;* and Bills of Inland Exchange are usually denominated *Drafts.* For example: If M. of New York is indebted to N. of New Orleans, to the amount of $500, and at the same time, N. owes C. of New York, $500; N. draws for this sum on M. of New York, and sends the bill to C. If M. accept the draft, both these debts may be discharged by means of one bill.

The following is the form of a *Draft.*

Baltimore, May 1st, 1849

$500.

Three months after date, pay to the order of Henry Ward. five hundred dollars, value received, and charge the same to the account of WILLSON & HUGHES

To Samuel Smith,
Merchant, New York.

Questions.—Art. 160. In calculating time, &c., what is not included? What is customary? What are they denominated?—Art. 161. What is a draft?

When a merchant in the United States draws on a banker, or a firm in London, the draft is styled *Bill on London*, or *United States on London:* and if he sells the bill at one dollar for 54d. sterling, the exchange is said to be at *par;* but if at more, or less than 54d. sterling for one dollar, the exchange is above or below par, accordingly.

Again, if a merchant in London draws on a banker in the United States, his draft is styled, *London on United States;* and the exchange will be above or below par, according as he sells it for more or less than 54d. sterling for the dollar.

If a merchant in the United States draws on a banker in Paris, the draft is styled, *United States on Paris;* and if the draft be on the United States, it will be *Paris on the United States.*

ART. **162.** A TABLE OF FOREIGN COINS,

Exhibiting their denominations, and their value in United States Currency.

GREAT BRITAIN AND IRELAND.

			Value in U. S. Money. $. cts. m.
4 Farthings	equal to	1 Penny, ...	
12 Pence	"	1 Shilling.	.22,2
20 Shillings	"	1 Pound sterling, . .	4.44,4
1 Crown	"	5 Shillings " . .	1.08,0
1 Sovereign	"	20 " " . .	4.86,0
1 Guinea	"	21 " " . .	5.07.5

NOTE.—The exchange value of the pound sterling is $4.44,4; its legal value at the mint is $4.86,6; it is received at the custom-house, in payment of duties, at $4.84. Its commercial value is generally 9 per cent. more than its exchange value. This per cent. is called the *premium*, and when given must be added to the exchange value.

Thus, the exchange being $4.44,4
To which we add 9 per cent. premium, .40,0

$4.84,4

QUESTIONS.—Art. 161. When a merchant in the United States draws on London, what is the draft called? When a merchant in London draws on the United States, what is the draft called?

		Value in U. S. Money. $. cts. m.
FRANCE.		
10 Centimes equal to	1 Decime,	01,8
10 Decimes “	1 Franc,	.18,7
1 Napoleon or Louis equal to 20 Francs,		3.72,0
1 Double Napoleon or Louis equal to 40 Francs,		7.44,0
1 Five franc piece,		.93,0
SPAIN.		
34 Maravedis equal to	1 Real,	.11,0
8 Reals “	1 Dollar of Plate,	.88,0
275 Maravedis “	1 Ducat of Exchange,	2.21,0
4 Dollars of Plate “	1 Pistole of Exchange,	3.88,4
AMSTERDAM.		
16 Pfennings equal to	1 Stiver,	.02,0
20 Stivers “	1 Florin or Guilder,	.40,0
12 Grotes, or Pence Flemish, or 6 Stivers	1 Shilling Flemisn,	.12,0
20 Shillings, or 6 Florins equal to	1 Pound, “	2.40,0
2½ Florins, or 50 Stivers “	1 Rix Dollar,	.96,0
HAMBURG.		
12 Pfennings equal to	1 Schilling or Sol,	
16 Schillings “	1 Mark,	28,5
3 Marks “	1 Rix Dollar.	85,5
DENMARK.		
12 Pfennings equal to	1 Skilling,	
16 Skillings “	1 Mark,	.08,7
6 Marks Danish “	1 Rix Dollar,	.52,5
RUSSIA.		
10 Kopecks equal to	1 Grieve,	.07,5
10 Grieves “	1 Ruble,	75,0
PRUSSIA.		
12 Pfennings equal to	1 Silver Grosch,	.02,3
30 Groschen “	1 Dollar,	69,0
AUSTRIA.		
4 Pfennings equal to	1 Creutzer,	
60 Creutzers “	1 Florin,	.48,5
1½ Florins “	1 Rix Dollar of Account,	.72,7
2 Florins “	1 Rix Dollar of Specie,	.97,0

PORTUGAL.

		Value in U. S. Money. $. cts. m.
1000 Rees equal to	1 Milree, . .	1.24,0
400 Rees "	1 Crusado of Exchange,	0.49,6
480 Rees "	1 New Crusado, .	0.59 5

ROME.

2 Mezzi Quattrini equal to	1 Quattrino,	
5 Quattrini "	1 Baioccho, . .	0.01,0
10 Baiocchi "	1 Paolo, . .	0.10,0
10 Paoli "	1 Scudo, or Rom. crow,	1.00,6

BENGAL AND CALCUTTA.

12 Pice equal to	1 Anna, . .	0.03,⅛
16 Anna "	1 Rupee, . .	0.50,0

GREECE.

100 Lepta, equal to	1 Drachme, . .	0.16,6

TURKEY.

3 Aspers equal to	1 Para, ...	.01,0
40 Paras "	1 Piaster, or Turkish doll.	.40 0

Art. **163.** The following are a few of the principal foreign coins made current in the United States, and their value affixed, by several acts of Congress, in the years 1834, 1843, and 1846.

GOLD.

	Value in U. S. Money. $. cts. m.
Doubloon of Spain, ...	15.50,0
" of Mexico, ...	15.55,0
" of the Republic of Columbia, . .	15.61,0
Moidore of Portugal, ...	6.59,0
Sovereign of Victoria, Great Britain, . . .	4.86,0
" of France, Napoleon, ...	3.85,0
Guinea of Great Britain, ...	5.07,5
Sovereign of Austria, ...	3.37,7
Double Ducat of Austria, ...	4.58,9
Ducat of Berne, ...	1.98,6
Pistole of "	4.54,2
Ducat, current of Denmark, . .	1.81,2
Ducat, specie " "	2.26,7
Ducat of Hamburg, ...	2.27,9
Ryder of Holland, ...	6.01,3

	Value in U. S. Money. $. cts. m
Double Ryder of Holland,	12.20,5
Ducat of Prussia, 1787,	2.27,9
Ducat of Russia, 1796,	2.26,7
Seguin of Genoa,	2.30,2
Pistole, old, of Geneva,	3.98,5
Pistole, new, of "	3.44,4
Rupee of Bombay, East Indies,	7.07,6
Rupee of Madras,	7.10,0
Ducat of Hanover,	2.29,6
Seguin of Rome,	2.25,1
Caroline of Wurtemberg,	4.89,8
Ducat of "	2.23,5

SILVER COINS.

The dollar of Chili,	1.01,0
The dollar of Central America and Brazil,	1.00,0
The Pillar of Spain, Mexico, Peru and Bolivia,	1.00,0
The 5 Franc piece of France,	0.93,0
Franc of France,	0.18,6
Prussian dollar, and those of the Northern States of Germany,	0.69,0
Florin of Austria,	0.48,5
Florin of the Southern States of Germany,	0.40,0
Specie dollar of Denmark,	1.05,0
" " Sweden and Norway,	1.06,0
Milree of Portugal,	1.12,0
" of Madeira,	1.00,0
" of Azores,	0.83,3
Rix dollar of Bremen,	0.78,7
Mark Banco of Hamburg,	0.35,0
Rouble of Russia,	0.75,0
Rupee of British India,	0.44,5
Pound of British Province of North America,	4.00,0
Pound of Jamaica,	3.00,0
Ducat of Naples,	0.80,0
Real of Plate of Spain,	0 10,0

ART. **164.** The various operations in the exchange of currencies, are generally performed by the Rule of Three, or by Practice. But the work may be greatly abbreviated by the following rules:

CASE I.

To reduce any foreign currency to Federal money.

RULE.

Multiply the currency to be reduced to Federal money, by the number of dollars or cents that will make an integer of that currency, and the product will be the answer in dollars and cents.

Ex. 1. *Baltimore,* May 1, 1849.
Exchange for 500£.

Ninety days after sight of this my first Bill of Exchange, (second and third of the same tenor and date unpaid,) pay to John R. Davis, or order, five hundred pounds sterling, with, or without further advice. Peter Andrews.

Robert Brown, Esq., Merchant, London.

What should be paid for the above bill?

OPERATION.

500£. × $4.444 = $2,222

In this example, we first found from the table, the exchange value of one pound sterling, and then multiplied the number of pounds, by the value. Hence we obtained $2,222 for the answer.

NOTE.—If the currency to be reduced to Federal money, consist of different denominations—*Reduce the lower denominations to the decimal of the higher, then proceed by the foregoing rule.*

Ex. 2. What is the value of 650£. 15s. 6d. exchange at $4.44,4.

OPERATION.

650£. 15s. 6d. = 650.775£.
650.775 × 4.44,4 = $2,892.04,4.

In this example, the currency to be reduced to Federal money, consisted of pounds, shillings and pence, we therefore

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QUESTIONS.—Art. 164. How are the operations in the exchange of currencies performed? What is the rule to reduce any foreign currency to Federal money? Explain the examples. In the Note, if the currency to be reduced consist of different denominaions, what must be done?

reduced the 15s. and 6d. to the decimal of a pound, by the rule under Art. 77, and then multiplied the sum by the value of one pound, as in the preceding example.

Ex. 3. The United States on Paris.—Reduce 25,452 francs and 50 centimes to United States currency.

OPERATION.

25,452fr. 50cts. = 25,452.5fr.

25,452.5fr. × 18.7cts. = $4,759.61,7

It will be observed in this example, that we first reduced the 50 centimes, to the decimal of a franc, and then multiplied by 18,7, the number of cents in one franc. The product, $4,759.61,7 is the answer nearly.

CASE II.

To reduce Federal money to any foreign currency.

RULE.

Divide the given currency by the number of dollars, or cents, that will make an integer of that currency to which it is to be reduced. The quotient will be the answer.

Ex. 1. Let it be required to change $2,222 to pounds sterling.

OPERATION.

$2,222 ÷ 4.44,4 = 500£.

In this example, we divided the given sum, by the number of dollars and cents in one pound sterling; hence we obtained 500£. for the answer.

Note.—If there be any remainder, after dividing the given currency, by the number of dollars and cents, that make an integer of that currency, it must be reduced to the next lower denomination, and the division continued.

Ex. 2. Let it be required to reduce $4,759.61,7 to francs, French currency; and $340,67 to florins, Amsterdam currency.

1. OPERATION.

$4759.61,7 ÷ 18.7cts. = 25452fr. 50 centimes.

Questions.—Art. 164. What is the rule for reducing Federal money to any foreign currency? Explain the examples. What is observed in the note?

2. OPERATION.

38cts.)$340.67.(896 florins. 10 stivers. *Ans.*
304
———
366
342
———
247
228
———
19
20 stivers
———
380

In the first example, we divided the given sum by 18.7, the number of cents in one franc, and the quotient was 25452 francs. We then multiplied the remainder by 100, the number of centimes in one franc, and continued the division; hence we obtained 25452 francs, 50 centimes for the answer.

In the second example, we divided the given sum by 38, the number of cents in one florin, which gave a quotient of 896 florins. We then multiplied the remainder 19 by 20, the number of stivers in one florin, again divided by 38, and finally obtained 10 stivers, which we placed in the quotient.

ENGLAND.

EXAMPLES FOR PRACTICE.

1. What must a merchant in New York pay for a bill of 943£. 17s. sterling, on London, the exchange being at $3.80. per £. *Ans.* $3,586.63.

2. United States on London. Reduce 350£. sterling, to Federal money. *Ans.* $1,555.40.

3. Liverpool on the United States. Reduce $1000, to pounds sterling, at par. *Ans.* 225£. 0s. 5¼d.+

4. *Baltimore*, March 10, 1849.
Exchange for £450. 10s. 6d. sterling.

Thirty days after sight, of this my first of exchange, (the second and third of like tenor and date not paid,) pay to John Roe, or order, four hundred and fifty pounds, ten shillings and six-pence sterling, with or without further advice from me. Samuel Jones.

Alexander Fox, & Co., *Merchants*, Liverpool.

What is the value of this bill in the United States money, exchange at $4.84 per £ sterling. *Ans.* $2,180.54,1

FRANCE.

1. What must a merchant in Boston pay for a bill on Paris for 76,000 francs, the exchange being 5 francs 8 centimes, for a dollar? *Ans.* $14,960.62+

2. If Simon Gilford of New York remit to Havre $17,280, to be exchanged at 5 francs 10 centimes per dollar; how many francs will he receive in exchange? *Ans.* 88,128 francs.

3. What is the value of a bill on Bordeaux, for 79,000 francs, exchange being 2 per cent. below par? *Ans.* $14 477.54

AMSTERDAM.

1. What sum in United States currency will be equivalent to 896 florins, 10 stivers, exchange at 38 cents per florin? *Ans.* $340.67.

2. Amsterdam on the United States. Reduce $340.67, to the currency of Amsterdam, exchange at 38 cents per florin. *Ans.* 896 florins. 10 stivers.

HAMBURG

1. Reduce 675 rix dollars, 2 marks, to United States money, exchange at 30 cents per mark. *Ans.* $608.10.

2. Hamburg on the United States. Reduce $608.10, to the currency of Hamburg, exchange at 30 cents per mark. *Ans.* 675 rix dol. 2 marks.

COPENHAGAN.

United States on Copenhagen. Reduce 896 rix dollars, 3 marks, to United States money, exchange at 50 cents per rix dollar. *Ans.* $448.25.

RUSSIA.

1 United States on Russia. What is the value of 7684 rubles, 8 grieves, in the currency of the United States, exchange at 75 cents per ruble? *Ans.* $5,763.60.

2. Russia on the United States. What is the value of $5763.60 in Russian currency? *Ans.* 7,684 rubles, 8 grieves.

PRUSSIA.

1. United States on Prussia. Reduce 4162 rix dollars, 00 good groschen to Federal money; exchange at 66 cents per rix dollar. *Ans.* $2,746.92.

2. Prussia on the United States. Reduce $2746.92, to Prussian currency; exchange at 66 cents per rix dollar. *Ans.* 4,162 rix dollars.

AUSTRIA.

1. A merchant holds a bill on Vienna for 876 rix dollars specie, 1 florin; what sum will be received for it, in United States currency, the exchange being at 97 cents per rix dollar? *Ans.* $850. 205.

2. Vienna on the United States. Change $850.20,5, to the currency of Vienna. *Ans.* 876 rix dol. specie, 1flo.

SPAIN.

1. United States on Spain. What is the value in United States currency of 7600 dollars plate, exchange at 75 cents per plate dollar? *Ans.* $5700.

2. Spain on the United States. What is the value of $5700, in Spanish curreney, exchange at 75 cents per dollar of plate? *Ans.* 7600 dollars of plate.

PORTUGAL.

1. United States on Lisbon. Reduce 964 milrees, 500 rees, to United States currency; exchange at $1.24 per milree. *Ans.* $1,195.98.

2. What is the value of $1195.98, in the currency of Portugal; exchange at $1.24 per milree? *Ans.* 964 milrees, 500 rees

EAST INDIES, BENGAL, CALCUTTA, &c.

1. United States on Calcutta. Reduce 432 repees, 12 annas to United States money; exchange at 50 cents per rupee. *Ans.* $216.37½

2. Reduce $216.37½, to the currency of Calcutta; exchange at 50 cents per rupee. *Ans.* 432 rupees, 12 annas

SECTION XLII

PARTNERSHIP, OR COMPANY BUSINESS.

Art. 165. Partnership is an association of two or more persons in business, with an agreement to share the profits and losses in proportion to the amount of stock of each.

The association is called a Firm, or Company. The money, or property invested is called the *Joint Stock*, or *Capital.* Each of the owners is called a Partner, and the profit, or loss the *Dividend.*

CASE I.

Art. 166. To find each partner's share of the profit or loss, when the stock is employed without regard to time, or for equal time.

RULE.

As the whole stock is to the whole gain or loss, so is each man's particular stock, to his particular share of the gain or loss.

Ex. Three persons entered into partnership with a capital of \$6000 : A put in \$1400 ; B put in \$3000 ; and C put in \$1600 ; their profits at the end of a year amount to \$1200. What is each man's share ?

OPERATION.

$$\text{As the stock } \$6000 : \$1200 :: \left\{ \begin{array}{l} 1400 : 280 = \text{A's share.} \\ 3000 : 600 = \text{B's share.} \\ 1600 : 320 = \text{C's share} \end{array} \right.$$

$$\underline{}$$

\$1200 Proof.

From this example, it will be seen, that we stated the sum and performed the operation by the rule for simple proportion, Art. 111. If the work be correct. the sum of each partner's share of the gain or loss will be equal to the amount of the gain or loss.

Questions.—Art. 165. What is partnership? What is the association called? The money invested? Each of the owners? What is the dividend?

EXAMPLES FOR PRACTICE.

1. Two merchants, C. and D. engage in trade with a capital of $10,000, of which C. put in $3000. and D. put in $7000; and they gained $1200. What is the share of each?

Ans. { C's. $360.
D's. $840.

2. A. B., and C. enter into partnership; A. put in $550, B put in $300, and C. put in $250; and they lose $200 What is each man's share of the loss?

Ans. { A's $100.
B's $54.54,5.
C's $45.45,4.

3. Three merchants by trading lost goods to the amount of $1920; now supposing A's share of the capital was $2880, B's $11520, and C's $4800; what sum of the loss will each man sustain?

Ans. { A's $288.
B's $1152
C's $480.

4. Suppose a merchant is indebted to O. $168, to P. $960, and to Q. $337.50; but at his death his estate is found to be worth only $983.28; what is the dividend of each creditor?

CASE II.

ART. **167.** When the partners employ their stock for unequal periods of time.

RULE.

Multiply each man's stock by the time it continued in trade; then proceed by the following proportion: As the sum of all the products, is to the whole loss, or gain, so is each particular product, to his share of the loss or gain.

EX. Two persons entered into partnership: A. put in $420 for 5 months, and B. put in $350 for 8 months; they gain $84. What is each man's share of the gain?

QUESTION.—Art. 167. What is the rule when the partners employ their stock for unequal periods of time?

OPERATION.

$420 × 5 = 2100 4900 : 84 :: 2100 : $36, A's gain.
$350 × 8 = 2800 4900 : 84 :: 2800 : $48, B's gain
4900 Proof 84

In this example, we first multiplied each man's stock by the time it continued in trade, and then proceeded to make a statement with the sum of the products, the gain, and each particular product, according to the rule for Simple Proportion, or Single Rule of Three.

Lastly, we added together each man's share of the gain, and it gave the whole gain, which proves the work to be correct.

EXAMPLES FOR PRACTICE.

1. Three men, A. B. and C. trade in company on the following terms: A. put in $300 for 5 months; B. put in $400 for 8 months, and C. put in $500 for 3 months; and they gained $100; what is each man's share of the gain?

Ans. $24.19,3 A's gain.
$51.61,3 B's gain.
$24.19,3 C's gain.

2. J. W. Brown commenced business January 1, with a capital of $3,200; and May 1, he took Wm. Smith into partnership, with a capital of $4,200; and at the end of the year they gained $240; what was each man's share of the gain?

Ans. $128, J. W. B's gain.
$112, W. S's gain.

3. Two merchants traded in company; A. put in $215 for 6 months, and B. $390 for 9 months, but by misfortune they lost $200; what will each lose?

Ans. $53.75, A's loss.
$146.25, B's loss.

4. A. B. and C. hold a pasture in common, for which they paid 19£. per annum. A. put in 8 cows for 6 weeks; B. put in 12 cows for 8 weeks; and C. put in 12 cows for 12 weeks; what must each pay of the rent?

SECTION XLIII.

EQUATION OF PAYMENTS.

Art. 168. Equation of Payments is a rule for finding the *average* or *mean* time of the payment of several sums of money, due at different times, so that they may be all paid at once, without loss to either debtor or creditor.

CASE I.

Art. 169. To find the average time of payment, when the sums due have been obtained at the same date, but have different terms of credit.

RULE.

Multiply each payment by its time, then divide the sum of the products by the sum of the payments, and the quotient will be the time required.

Note.—When a payment is at the *present* time, that payment has no product, *but it must be added with the other payments in finding the average time.*

Ex. A merchant owes $1500, which he agrees to pay as follows: $500 in 6 months, $500 in 9 months, and $500 in 12 months; require the average time for the whole payment?

OPERATION.

$500 × 6 months = 3000
$500 × 9 months = 4500
$500 × 12months = 6000
——— ———
$1500 $1500)13500
———
Ans. 9 mo.

In this example, we multiplied each payment by its time and divided 13500, the sum of the products, by 1500 the sum of the payments. Hence the average time of payment is 9 months.

Examples for Practice.

1. A merchant has owing to him $380, to be paid as follows: $100 in 6 months; $120 in 7 months; $160 in 10 months, but agrees that the whole shall be paid at one time; require that time? *Ans.* 8mo

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Questions.—Art. 168. What is equation of payments? Art. 169.—Whatis the rule to find the average time of payment, &c

2. A man purchased goods to the amount of $840, and agreed to make his payments as follows: ¼ in 3 months, ¼ in 6 months, ¼ in 9 months, and ¼ in 12 months; but afterwards agreed to pay the whole at one time; when shall that time be? *Ans.* 7mo. 15 days.

3. A merchant owes $2,400, of which he pays $480 at present, and gives his note for $960 at 5 months, and the balance at 10 months; but agrees to make one payment, and wishes to know the time? *Ans.* 7mo. 15 days.

4. A man purchased a house for $4000; $1000 of which is to be paid at present; $1000 in one year, and the balance in 2 years; but agreed to make one payment of the whole: require the time?

CASE II.

Art. 170. To find the average or mean time of payment, when the several sums have different dates.

RULE

Find the time when each of the sums will become due, then multiply each sum by the number of days from its date to the date of the last, and divide the sum of the products by the sum of the payments. The quotient will be the averaged time required, in days, from the earliest payment.

Ex. 1. A man purchased goods to the amount of $1200 on various terms of payment, as follows: March 4, $400, April 6, $400, June 20, $400; what is the averaged time of purchase?

OPERATION.

$$
\begin{array}{lr}
\$400 \times 108 = & 43200 \\
\$400 \times 75 = & 30000 \\
\$400 & \underline{} \\
\underline{} \quad 12,00) & 732,00 \\
\$1200 & \underline{} \\
 & 61 \text{ days.}
\end{array}
$$

61 days prior to June 20 = April 20, *Ans.*

Ex. 2. J. Cox purchased goods of W. Jones, on 8 months credit, as follows: March 12, $500, May 3, $900, and July 6, $300; what is the averaged time of payment? *Ans.* April 29.

SECTION XLIV.

PROFIT AND LOSS.

Art. 171. Profit and Loss is a rule by which merchants and other traders estimate their gain or loss in buying and selling goods; and also determine, at what rate goods must be sold in order to gain or lose a certain per cent.

CASE I.

Art. 172. To find the whole gain or loss on any quantity of goods.

RULE.

Find the gain or loss on one article, by subtracting the buying from the selling price, or the selling from the buying price; then multiply the whole number of articles, by the gain or loss on one article, and the product will be the profit or loss on the whole.

Ex. If I buy 25 barrels of flour for $5 per barrel, and sell them for $5.50 per barrel, what will I gain on the whole?

Ans. $12.50

OPERATION.

$5.50 selling price. barrels 25 × $0.50 = $12.50
$5.00 buying price.

50 gain per barrel.

Examples for Practice.

1. Bought 7 dozen of hats, at $2.50 per hat, and then sold them at $2.87½ a piece; what was the gain per hat, and what was the whole gain?

Ans. $0.37½ per hat, $31.50, whole gain.

2. Bought 3 boxes of shoes containing 640 pair, for $1.12½ per pair; but being damaged, I am willing to sell them for $0.98 per pair; what will I lose on the transaction?

Ans. $92.80

Questions.—Art. 171. What is profit and loss?—Art. 172. What is the rule to find the profit or loss on any quantity of goods?

CASE II.

Art. 173. To find the profit or loss per cent. in buying and selling goods, the buying and selling price being given.

RULE.

I. *Find the loss or gain on one article, as in the last case. Then—*

II. *As the cost of the goods is to $100, so is the gain or loss on one article to the gain or loss per cent.*

Ex. If I buy hats at $0.52 a piece, and sell them at $0.65 per hat; what is the gain per cent? *Ans.* $0.25.

OPERATION.

$0.65—$0.52=$0.13; then $0.52 : $100 : : $0.13 : $0.25 the gain per cent.

Examples for Practice.

1. Bought sugar at 5½ cents per pound; and sold it at 6 cents per pound; what was the gain per cent? *Ans.* 9$\frac{1}{11}$.

2. Bought 8 barrels of flour for $40, and lost 50cts. per barrel in the sale; what was the loss per cent.? *Ans.* 10.

3. A man bought goods to the amount of $43.20, and sold them for $60, at 4 months credit; what was the gain per cent.? *Ans.* $116.66,6+.

4. Bought rice at 4¾ cents per pound, and sold it at 5cts. per pound; what was the gain per cent.? *Ans.* $0.05,26.

5. Bought one hogshead of molasses containing 85 gallons, for $21.30; but by accident lost 10 gallons; what will be the loss per cent., on the money laid out?
Ans. 12 cents nearly.

6. Paid $184 for one ton of steel; what is the profit or loss, if I sell 14 tons, at 7cts. per pound?
Ans. $380.80 loss.

CASE III.

Art. 174. To find at what price goods must be sold to gain or lose a given per cent.

Questions.—Art. 173. What is the rule for finding the profit or loss in buying and selling goods?—Art. 174. What is the rule for finding at what price goods must be sold, to gain a given per cent.?

RULE.

As $100 *are to* $100, *with the profit added, or the loss subtracted, so is the given price to the price required.*

Ex. If I buy flour at $5.40 per barrel, at what price must I sell it per barrel, to gain 25 per cent.? *Ans.* $6.75

OPERATION.

$100 : $125 :: $5.40 : $6.75, the selling price.

EXAMPLES FOR PRACTICE.

1. If I buy flour at $5 per barrel, at what price must I sell it to gain 12½ per cent.? *Ans.* $5.62½.

2. Bought 75 yards of cloth at $5 per yd.; how shall I sell it per yard in order to gain 50 per cent.? *Ans.* $7.50

3. Bought 7cwt. 3qr. 12lbs. of sugar, for $88, at what rate must I sell it per pound, in order to gain 20 per cent.? *Ans.* 12 cts.

CASE IV.

ART. **175.** To find the cost, when the selling price and gain or loss per cent. are given.

RULE.

As $100 *with the gain per cent. added or the loss per cent. subtracted, is to* $100, *so is the selling price to the cost.*

Ex. 1. If I sell flour at $5 per barrel, and lose 20 per cent. by the transaction; what did it cost per barrel? *Ans.* $6.25

OPERATION.

$100 — 20 = 80; then, $80 : $100 :: $5 : $6.25.

Ex. 2. If I sell wheat at $1.25 per bushel and gain 25 per cent.; what did it cost me per bushel? *Ans* $1.00

OPERATION.

$100 + 25 = $125; then, $125 : $100 :: $1.25 : $1.00

QUESTION.—Art. 175. What is the rule to find the cost, when the selling price, &c., are given?

EXAMPLES FOR PRACTICE

3. If I sell wood at $5 per cord, and gain 25 per cent. by the transaction; what did it cost? *Ans.* $4.00.

4. My horse having met with an accident, I am willing to sell him for $40, and by so doing, I lose 40 per cent.; what did he cost me? *Ans.* $66.66 $\frac{1}{}$.

SECTION XLV.

BARTER.

ART. 176. Barter is the exchange of one commodity for another without loss to either party.

CASE I.

When the quantity of one commodity is given with its value, to find what quantity of another, at a given price, may be had in exchange for it.

RULE.

Find the value of that commodity, whose quantity is given, by multiplying it by its price per pound, yard, &c.; then divide this value by the price of one article of that commodity received in exchange.

Ex. What quantity of sugar at 7 cents per pound, must I receive in exchange for 175lbs. of rice at 4 cents per pound? *Ans.* 100lbs.

OPERATION.

lbs. cts. cts.
175 × 4 = 700 ÷ 7 = 100lbs. of sugar.

EXAMPLES FOR PRACTICE.

1. How many pounds of candles at 10cts. per pound, must I receive in exchange for 112lbs. of chocolate at 4cts. per pound? *Ans.* 44lbs. 12oz.+

QUESTIONS.—Art. 176. What is barter? What is the rule for case I.?

2. What quantity of rice at 28s. per cwt. must I receive in barter, for 3.5cwt. of raisins, at 5d. per pound?
Ans. 5cwt. 3qr. 9lb

3. How many yards of cloth at $2.50 per yard, should be received in barter, for 36 barrels of flour, at $5.50 per barrel?
Ans. 79⅕yds.

4. How many pounds of cheese at 12½cts. per pound must be given in exchange for 340lbs. of bacon, at 9cts. per pound?
Ans. 244⅘lbs.

5. What quantity of tobacco at 11cts. per pound must I receive for 1500 cigars, at $12.50 per thousand?
Ans. 170 lbs. 7oz. 4dr. +

CASE II.

Art. 177. When a part of the value of the commodity is paid in cash, and the remainder in goods.

RULE.

Subtract the cash from the value of the given commodity, and then work by the preceding rule.

Ex. How many yards of cloth at $1.25 per yard, must be given, with $50 in cash, for 952yds. of calico, at 12½cts. per yard? *Ans.* 55⅕yds.

OPERATION.

yds. cts.
952 × 12½ = $119.00
Subtract the cash 50.
$69 ÷ $1.25 = 55⅕yds.

Examples for Practice.

1. How many pounds of sugar, at 6¼cts. per lb. should I receive, with $25 cash, for 525lbs. of tobacco at 10cts. per lb.?
Ans. 440lbs

2. How many pounds of cotton, at 8cts. per lb. should I receive with $50 cash, for 800 yards of muslin at 12½cts. per yard?
Ans. 625lbs

Question.—Art. 177. What is the rule for case II.?

3. How many pounds of pork at 5¼cts. per lb., must be given, with $53.33 cash, for 41 barrels of flour, at $4 per barrel? *Ans.* 2012.18lbs

CASE III.

Art. 178. The rate of one commodity being given, to find how the other should be rated.

RULE.

Divide the value of one commodity by the quantity of the other.

Ex. If I barter 64yds. of carpeting, at 75cts. per yd., for 24yds of cloth, what was the cloth per yard? *Ans.* $2.00.

OPERATION.

$$\overset{\text{yds.}}{64}\times\overset{\text{cts.}}{75}=4800\div\overset{\text{yds.}}{24}=\$2.$$

Examples for Practice.

1. A. barters 500 gallons of brandy, at $1.50 per gallon to B., for 750 gallons of wine; what was the wine per gallon? *Ans.* $1.

2. O. delivered 3 hogsheads of brandy, at 6s. 8d. per gallon to P., for 126yds. of cloth; what was the cloth per yard? *Ans.* 10s.

3. If 24yds. of cloth be given, for 5cwt. 1qr. of tobacco, at $5.07 per cwt., what was the cloth per yard? *Ans.* $1.11 nearly.

CASE IV.

Art. 179. When the price of one commodity has been raised in barter, to find how to raise the other in proportion

RULE.

As the price of one commodity, is to that of the other, so is the bartering price of one to the bartering price of the other.

Ex. A. has sugar at 6cts. per lb. ready money, but in

Questions.—Art. 178. What is the rule for case III.?—Art. 179. What is the rule for case IV.?

barter demands 7½cts. per lb.; B. has rice at 4cts. per lb.; how mus B. rate his rice that it may be equivalent to A's.? *Ans.* 5cts

OPERATION.

cts. cts. cts.
6 : 4 :: 7½ : 5cts.

Examples for Practice.

1. A merchant has coffee, at 12cts. per lb., but in barter he asks 12½cts. per lb.; I have tea, at 75cts. per lb.; what should I charge him in barter, per pound for the tea? *Ans.* $0.78,12.

2. M. has muslin at 10cts. per yd., but in barter asks 12cts.; and N. has 3610lbs. of sugar at 7cts. per lb., which he wishes to barter for the muslin, paying at the same time $84, cash. At what rate is the sugar in barter, and how much muslin must M. give N.? *Ans.* sugar at 8⅖cts. per lb. and 1827yds.

3. A. has linen at $0.50 per yd., but in barter he demands $0.60 per yd.; and B. has cloth at $1.75 per yd. At what price should the cloth be rated in barter? *Ans.* $2.10

SECTION XLVI.

ALLIGATION.

Art. **180.** Alligation teaches the method of finding the mean value of a mixture composed of several ingredients of different values. It is of two kinds, *Alligation Medial*, and *Alligation Alternate*.

ALLIGATION MEDIAL.

Art. **181.** Alligation Medial is the method of finding the mean price of a mixture composed of several articles or ingredients, the quantity and price being given.

Art. **182.** To find the mean price of several articles, at different prices, or different qualities, we have the following

RULE.

Find the value of each ingredient, and divide the amount of the values by the sum of the ingredients; the quotient will be the price of the mixture.

EXAMPLES FOR PRACTICE.

1. A grocer mixed 20 gallons of wine at 50cts. per gallon with 30 gallons, at 75cts. per gallon, and 50 gallons at 90cts per gallon; what is a gallon of the mixture worth?

OPERATION.

$0.50 × 20 = $10.00
$0.75 × 30 = $22.50
$0.90 × 50 = $45.00

sum of ingredients 100 77.50 value.
Then $77.50 ÷ 100 = $0.77,5.

2. If 4oz. of silver worth 60 cents per ounce, be melted with 8oz. worth 48 cents per ounce; what is an ounce of the mixture worth? *Ans.* $0.52.

3. A grocer mixed 30lbs. of sugar, at 10cts. per lb., 20lbs. at 7cts., and 20lbs. at 6cts.; what is a pound of the mixture worth? *Ans.* 8cts.

4. A farmer mixed 4 bushels of wheat, at $1.50 per bush., 3 bushels of rye, at $0.70 per bushel, and 2 bushels of corn at $0.50 per bushel; what is a bushel of the mixture worth? *Ans.* $1.01+.

ALLIGATION ALTERNATE.

ART. **183.** Alligation Alternate is a method of finding what quantity of several given articles, must be taken to make a mixture of a certain mean value.

RULE.

I. *Place the prices of the ingredients under each other, in the order of their value, and place the mean rate on the left hand of them.*

II. *Connect the price of each ingredient, which is in value less than the price of the mixture, with one that is greater.*

III. *Take the difference between the price of each ingredient* *and that of the mixture, and place it opposite to the price with which it is connected.*

IV. *The number set opposite to each price is the quantity of the ingredient to be taken at that price.*

Ex. I wish to mix two kinds of tea, one at 75cts., and the other at 90 cents per pound, so that the mixture may be worth 80 cents per pound. How many pounds of each must I take? *Ans.* 10lb. at 75cts. and 5lb. at 90cts.

OPERATION.

$$80\left\{\begin{array}{l}75\\90\end{array}\right\rbrack\begin{array}{l}10\text{lbs. at }75\text{cts.}\\5\text{lbs. at }90\text{cts.}\end{array}$$

It will be observed, that we connected the price that is less than the *mean* price with the price which is greater, and set the difference between each price and the mean price opposite the price with which it is connected; these numbers denote the quantity of each ingredient to be taken.

EXAMPLES FOR PRACTICE.

1. I wish to mix wines at 16s., 18s. and 22s. per gallon, so that a gallon of the mixture may be worth 20s.; how much must I take of each kind? *Ans.* 2gal. at 16s., 2gal. at 18s. and 6gal. at 22s.

2. A goldsmith has gold of 16, 18, 23 and 24 carats fine; what quantity must be taken that the mixture may be 21 carats fine? *Ans.* 3 of 16, 2 of 18, 3 of 23 and 5 of 24.

CASE II.

ART. **184.** When the quantity of one of the simples is given to find the quantity of each of the others.

RULE.

I. *Find the proportion of the quantities of the simples as in Case I.*

II. *Then say, as the number opposite the simple whose quantity is given, is to each of the differences separately, so is the quantity given to the several quantities required.*

Ex. How much coffee, at 6, 10, and 13 cents. per lb. must be mixed with 20lb. at 15 cents per lb. so that the mixture may be worth 11 cents per lb.?

OPERATION.

$$11\left\{\begin{array}{ll}6 & 4\\ 10 & 2\\ 13 & 1\\ 15 & 5\end{array}\right\}\text{Differences.}\quad \text{Then. }\left.\begin{array}{l}5 : 1 :: 20 : 4\\ 5 : 2 :: 20 : 8\\ 5 : 4 :: 20 : 16\end{array}\right\}\textit{Ans.}$$

Examples for Practice.

1. How much oats at 50cts. per bushel, corn at 60cts. and beans at $1.50 per bushel, should I mix with 30 bushels of peas at $1.70, that I may sell the mixture at $1.25 per bush.?
Ans. 18bu. oats, 10bu. corn, 26bu. beans.

2. A distiller would mix 40 gallons of brandy at $1.20 per gallon, with another kind at $0.70, and spirits at $0.40 per gal.; what quantity of each sort must be taken, that the mixture may be worth $0.80 per gallon?

SECTION XLVII.

INVOLUTION.

Art. **185.** Involution is the method of finding any required power of a given number or quantity. The *power* of a number is the product arising from multiplying any given number, called the root, a certain number of times continually by itself: Thus, $4 \times 4 = 16$, or the *square* of 4; again $3 \times 3 \times 3 = 27$; the number 27 is the third power, or *cube* of 3; and the 3 itself is the root.

The number which denotes the power is called the *index* or *exponent* of the power, and is represented by a small figure placed at the right of the root: thus, the second power of 4 is written 4^2, and the third power of 6 is written 6^3, &c.

Art. **186.** To raise a number to any power, we have the following

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Questions.—Art. 185. What is involution? What is a power? What is the exponent, and how is it represented? Art. 186.—What is the rule for raising a number to any power?

RULE.

Multiply the number continually by itself as many times less ONE, *as there are units in the exponent: the last product will be the power sought.*

Ex. What is the first, second, third, and fourth power of 4?

OPERATION.

$4 = 4$ the first power of 4.
$4^2 = 4 \times 4 = 16$ the second power of 4.
$4^3 = 4 \times 4 \times 4 = 64$ the third power of 4.
$4^4 = 4 \times 4 \times 4 \times 4 = 256$ the fourth power of 4.

EXAMPLES FOR PRACTICE.

1. What is the square of 6? *Ans.* 36.
2. What is the third power of 5? *Ans.* 125.
3. What is the fourth power of 7? *Ans.* 2401.
4. What is the fifth power of 10? *Ans.* 100000.
5. What is the sixth power of 15? *Ans.* 11390625
6. What is the seventh power of 20? *Ans.* 1280000000

SECTION XLVIII.

EVOLUTION.

ART. **187.** EVOLUTION, is the method of finding the root of any given power or number, and is therefore, the reverse of Involution.

The *root* of any number, is a number, which, being multiplied by itself a certain number of times, will produce that number, or power. Thus, 4 is the *root* or *square* of 16; because $4 \times 4 = 16$; and 3 is the *cube* root of 27; because $3 \times 3 \times 3 = 27$.

Those roots that can be exactly found are called *rational*, as, 4 the root of 16, is *rational*.

But those roots which cannot be exactly found are denominated *surd* roots; as, the root of 10, would be a *surd* root.

The root of a number is denoted by writing the sign $\sqrt{}$, before the power, with the index of the root over it: Thus, to indicate the square root of 16, it is written $\sqrt[2]{16}$, or without the index of the power: as $\sqrt{16}$, and the cube root of 27, $\sqrt[3]{27}$.

EXTRACTION OF THE SQUARE ROOT.

Art. 188. The Square Root is the second power of any number; and it is called *square*, because the square or second power of a number represents the contents of a square surface, of which the square root is the length of one side.

Art. 189. To extract the square root of any number is to find a number, which, being multiplied by itself, will produce the given number.

Before giving the rule for the extraction of the square root, we will show how the squares of numbers are formed.

Roots,	1	2	3	4	5	6	7	8	9	10
Squares,	1	4	9	16	25	36	49	64	81	100

It will be observed, that the numbers in the second line are the squares of those in the first, and that they are produced by multiplying each figure by itself. The figures in the first line are the *square* roots of those in the lower line.

Art. 190. To extract the square root of whole numbers we have the following

RULE.

I. *Begin at the right hand, and separate the given number into periods of two figures each, by writing a dot over the place of the units, another over the place of hundreds, and so on.*

II. *Find the greatest square in the first period on the left hand, and place its root on the right, after the manner of the quotient in division. Subtract the square of the root found from the first period, and to the remainder bring down the second period of figures for a dividend.*

III. *Double the root already found for a divisor, and place it on the left hand of the dividend. Find how often the divisor is contained in the dividend, exclusive of the right hand figure,*

Questions.—Art. 190. What is the rule for the extraction of the square root? Explain the operation?

and place the result in the root, and also at the right of the divisor.

IV. *Multiply the divisor, with this figure annexed, by the last figure of the root and subtract the product from the dividend. To the remainder bring down the next period for a new dividend.*

V. *Double the figures already found in the root, for a new divisor, and continue the operation as before, until all the periods have been brought down.*

Proof.—Multiply the root by itself, and add the remainder if any.

Note 1.—There will be as many figures in the root, as there are periods in the given number.

Note 2.—If the dividend should not contain the divisor, a cipher must be placed in the root, and also at the right of the divisor, and the next period brought down.

Note 3.—If the given number has not an exact root, ciphers may be annexed to the remainder, forming new periods, each of which will give a decimal place in the root.

Note 4.—When the given number consists of whole numbers and decimals, the root is extracted in the same manner as whole numbers, except in pointing off the decimals, we commence at the *decimal point*, and place a dot over every second figure towards the right hand, filling the last place, if not complete, with a cipher.

Ex. Let it be required to extract the square root of 2025.

OPERATION.

$$\begin{array}{r l} & 2\dot{0}2\dot{5}\,(45\ \mathit{Ans.} \\ & 16 \\ \hline 85) & 425 \\ & 425 \\ \hline \end{array}$$

It will be observed in this example, that we first separated the given number into periods of two figures each, by writing dots over them. We then found that the greatest square in the left hand period, was 16, which we placed under that period, and 4, its root, on the right of the given number, for the figure of the root. We next subtracted 16 from 20, and to the remainder, brought 25, the next period. We then doubled 4, the root already found, for a divisor, and placed it on the left of the new dividend 425, and inquired how often the 8 is contained in 42, the tens and hundreds of the dividend, omitting 5, the units; and having ascertained that 42 would contain 8, 5 times, we place the 5 in the quotient for the second figure of the root, and also on the right of 8 the divisor, and multiplied 85 by 5, the last figure of the root, and placed the product under 425, the dividend, and on subtracting, we found that there was no remainder. Hence, 45 is the required root.

EXAMPLES FOR PRACTICE.

1. What is the square root of 2916? *Ans.* 54.
2. What is the square root of 998001? *Ans.* 999
3. What is the square root of 234.09? *Ans.* 15.3.
4. What is the square root of 10? *Ans.* 3.16+.
5. If 484 trees be planted in a square orchard, how many must be in a row each way? *Ans.* 22.
6. A general has 4096 men, how many must be placed in rank and file to form them into a square? *Ans.* 64.
7. I wish to plant 5625 trees in a square orchard, how many should I plant in a row? *Ans.* 75.
8. If a certain field measure 20 rods on each side, how much will the side of a square field measure, containing 4 times as much? *Ans.* $\sqrt{}20 \times 20 \times 4 = 40$ rods.

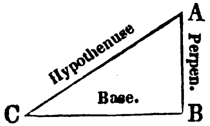
ART. **191.** In every *right angled triangle* the square of the longest side, called *hypothenuse* is equal to the sum of the squares of the other two sides. Therefore, to find the hypothenuse when the other two sides are given, or to find one of the sides when the hypothenuse and the other side are given, we have the following

RULE.

I. *Square the other two sides and add the squares together, and the square root of their sum will be the hypothenuse.*

II. *From the square of the hypothenuse subtract the square of the given side, and the square root of the remainder will be the other side.*

Ex. The base of a right angled triangle is 4 feet, and perpendicular 3, what is the length of the hypothenuse?



OPERATION.

$4^2 = 16$
$3^2 = \ \ 9$

Sum of the square $25 \quad \sqrt{25} = 5$ *Ans.*

QUESTIONS.—Art. 191. What is said of every right angled triangle? What is the rule for finding the hypothenuse, and the other sides?

EXAMPLES FOR PRACTICE.

1 The wall of a fortress is 32 feet high, before which is a ditch 24 feet wide; what must be the length of a ladder to reach from the top of the wall to the opposite side of the ditch? *Ans.* 40 feet

2. If the ladder be 40 feet long and the wall 32 feet high, how wide is the ditch? *Ans.* 24 feet

3. There is a field 800 rods long and 600 wide, what is the distance between the two opposite corners? *Ans.* 1000 rods

4. The distance between the lower ends of two equal rafters, is 32 feet, and the height of the pitch 12 feet; require the length of each rafter? *Ans.* 20 feet.

ART. **192.** To extract the square root of a vulgar fraction.

RULE.

Reduce it to its lowest terms, then extract the square root of the numerator, for a numerator, and that of the denominator for a denominator.

NOTE.—A mixed number must be reduced to an improper fraction, and the root extracted by the above rule. If the fraction be a *surd*, it must be reduced to its equivalent decimal, and the root extracted as in whole numbers.

EXAMPLES FOR PRACTICE.

1. What is the square root of $\frac{4}{25}$? $\frac{\sqrt{4}}{\sqrt{25}} = \frac{2}{5}$ *Ans*
2. What is the square root of $\frac{16}{100}$? *Ans.* $\frac{4}{10}$
3. What is the square root of $\frac{81}{144}$? *Ans.* $\frac{3}{4}$
4. What is the square root of $20\frac{1}{4}$? *Ans.* $4\frac{1}{2}$
5. What is the square root of $\frac{3}{4}$? *Ans.* .866+

EXTRACTION OF THE CUBE ROOT.

ART. **193.** The extraction of the cube root of a number consists in finding a *second* number, which being multiplied into itself twice will produce the given number.

QUESTION.—Art. 192. What is the rule for extracting the square root of a vulgar fraction?

The cube of a number, therefore, is produced by multiplying a number twice by itself: Thus,

Roots,	1	2	3	4	5	6	7	8	9	10
Cubes,	1	8	27	64	125	216	343	512	729	1000

ART. **194.** To extract the cube root, we have the following

RULE.

I. *Separate the given number into periods of three figures each, by putting a point over the unit figure, and every third figure beyond the place of units.*

II. *Find the greatest root in the left hand period, and place it in the quotient.*

III. *Subtract the cube of the number thus found from the said period, and to the remainder bring down the next period, and call this the dividend.*

IV. *Multiply the square of the quotient by* 300, *calling it the divisor.*

V. *Seek how many times the divisor may be had in the dividend, and place the result in the root; then multiply the divisor by this quotient figure, and write the product under the dividend.*

VI. *Multiply the square of this quotient figure by the former figure or figures of the root, and this product by* 30, *and place the product under the last; under all write the cube of this quotient figure, and call their amount the subtrahend.*

VII. *Subtract the subtrahend from the dividend, and to the remainder bring down the next period for a new dividend, with which proceed as before, and so on, till the whole is finished.*

NOTE 1.—If it happens that the divisor is not contained in the dividend, a cipher must be put in the root, and the next period must be brought down for a dividend.

NOTE 2.—The same rule must be observed for continuing he operation and pointing off for decimals, as in square root.

Ex. 1. I have 13824 feet of timber in blocks of 1 cubic foot each, and I wish to place them in a cubic pile, what must be the length of each side? *Ans.* 24 feet.

QUESTIONS.—Art. 193. What is the extraction of the cubic root? What is the rule? What is said in the first note? In the second?

OPERATION.

$$\begin{array}{rrl}
 & 1\dot{3}82\dot{4}\,(24 & \\
 & 8 & \\
2^2\times 300 = 1200) & 5824 & \text{dividend.} \\
 & 4800 & \text{1st addition.} \\
4^2\times 2\times 30 = & 960 & \text{2nd addition.} \\
4^3 = & 64 & \text{3rd addition.} \\
 & 5824 &
\end{array}$$

We first divided the number into periods as directed by the rule, and then found the greatest root in left hand period, which we placed to the right of the dividend, and subtracted its cube from the left hand period. After bringing down the next period, we multiplied the square of the root already found by 300, for a divisor, we found this product was contained in the dividend 4 times. We placed the 4 in the root and multiplied the divisor, 1200 by it, and placed the quotient under the dividend. We then multiplied the square of the last figure of the root by the first, and that product by 30, and called it 2nd addition; and lastly, we cubed the last figure of the root, and called it the 3rd addition, and then added all the additions together, and found their sum equal to the dividend. Hence we obtain 24, as the cube root of 13824.

Examples for Practice.

2. What is the cube root of 74088? *Ans.* 42

3. What is the cube root of 389017? *Ans.* 73.

4. There is a cellar to be dug that is 12 feet long, and the same in breadth and depth; how many solid feet of earth are to be taken out of it? *Ans.* 1728.

5. A stone of a cubic form contains 474552 solid feet; what is the superficial contents of one of its sides? *Ans.* 6084.

6. A carpenter wishes to make a cubical cistern to contain 2744 cubic feet of water; what must the length of one side be? *Ans.* 14 feet.

ART. **195.** When it is required to extract the cube root of a vulgar fraction, or mixed number, it must be reduced in the same manner as directed in square root. (Art. 192.)

QUESTION.—Art. 195. How do you extract the cube root of a vulgar fraction?

EXAMPLES FOR PRACTICE.

1. What is the cube root of $\frac{512}{1728}$? *Ans.* $\frac{2}{3}$.
2. What is the cube root of $\frac{729}{4096}$? *Ans.* $\frac{9}{16}$.
3. What is the cube root of $42\frac{7}{8}$? *Ans.* $3\frac{1}{2}$.
4. What is the cube root of $\frac{4}{9}$? *Ans.* .763.

SECTION XLIX.

ART. 196. GENERAL RULE FOR EXTRACTING THE ROOTS OF ALL POWERS.

I. PREPARE *the given number for extraction, by pointing it as the root directs.*

II. *Find the first figure in the root, and subtract its involution from the first period.*

III. *To the remainder, annex the first figure in the next period. Call this a dividend.*

IV. *Involve the whole root last found, into the next less power to that given, and multiply by the index of the given power, and call this a divisor.*

V. *Find a quotient figure by division, and annex it to the root.*

VI. *Involve all the roots thus found into the given power, and subtract this from the number of periods in the given number, as are represented by the last figure brought down.*

VII. *To the remainder, bring down the first figure of the next period, for a new dividend.*

VIII. *Find a new divisor, as before, and thus proceed to the end*

Ex. 1. What is the 4th root of $56\dot{2}491\dot{3}456\dot{1}$(4 8 7 *Ans*

2 5 6

2 5 6)3 0 6 4 dividend

5 3 0 8 4 1 6 subtrahend.

4 4 2 3 6 8)3 1 6 4 9 7 4 dividend.

5 6 2 4 9 1 3 4 5 6 1 subtrahend.

4 × 4 × 4 × 4 = 2 5 6 divisor.
4 8 × 48 × 48 × 48 = 5 3 0 8 4 1 6 subtrahend.
4 8 × 4 8 × 4 8 × 4 = 4 4 2 3 6 8 divisor.
4 8 7 × 4 8 7 × 4 8 7 × 4 8 7 = 5 6 2 4 9 1 3 4 5 6 1 subtrahend.

EXAMPLES FOR PRACTICE.

2. What is the fourth power of 97.41? *Ans.* 3.141599

3. What is the sixth power of 21035.8? *Ans.* 5.25403.

SECTION L.

ARITHMETICAL PROGRESSION.

ART. **197.** ARITHMETICAL PROGRESSION is a series of numbers which increase or decrease by a common difference: thus, 2, 4. 6, and 8 increase in arithmetical proportion, because their common difference is 2; and 12, 9, 6 and 3 decrease in the same proportion, because their common difference is 3.

ART. **198.** The numbers forming the progression, are called the *terms*, of which there are five, viz: *the first term*, or *first extreme; the last term*, or *last extreme; the number of terms; the common difference, and the sum of the terms.*

CASE I.

ART. **199.** To find the *last* term, when the first term, the common difference, and number of terms are given.

RULE.

Multiply the number of terms less 1, *by the common difference, and to the product add the first; the sum will be the last term.*

Ex. 1. If the first term is 2, the number of terms 7, and the common difference 6, what is the last term? *Ans.* 38.

OPERATION.

$2+(7-1)\times 6=38$ last term.

2. There were 16 boys in a class, and a person gave the foot boy 25 cents, the next five cents more, and so on to the head; what did the boy at the head of the class receive?

Ans. $1.

QUESTIONS.—Art. 197. What is arithmetical progression?—Art. 198. What are the number of terms?

CASE II.

Art. 200. To find the number of terms, when the extremes and common difference are given.

RULE.

Divide the difference of the extremes by the common difference, and the quotient, increased by 1, *will be the number of terms.*

Ex. 1. Let the extremes of a series be 2 and 29, and common difference 3; what is the number of terms? *Ans.* 10.

OPERATION.

$29-2=27\div3=9+1=10$ the number of terms.

2. A man on going a journey, travelled the first day 10 miles, and the last day 40, and each day he increased 5 miles; how many days did he travel? *Ans.* 7 days.

CASE III.

Art. 201. To find the sum of all the terms, when the extremes and number of terms are given.

RULE.

Multiply the sum of the extremes by the number of terms, and half the product will be the sum of all the terms.

Ex. 1. Let the extremes of a series be 5 and 35, and the number of terms 8; what is the sum of the series? *Ans.* 160.

OPERATION.

$35+5=40\times8=320\div2=160$ the sum of the series

2. A man engaged to labor for another 12 months: for the first month he was to receive $5, and for the last month 40; and in each successive month he was to have an equal addition to his wages; what sum will he receive at the end of the year? *Ans.* $270

SECTION LI.

GEOMETRICAL PROGRESSION.

Art. **202.** Geometrical Progression is a series of numbers increasing or decreasing by one continual multiplier or divisor, called the ratio: Thus 2, 4, 8 and 16 increase by the continued multiplication of 2 and 16, 8, 4 and 2 decrease continually by 2.

Art. **203.** When any *three* of the *five* following terms are given, the other two may be found:

1st. The first term, or extreme. 2nd. The last term, or last extreme. 3rd. The number of terms. 4th. The ratio. 5th. The sum of the terms.

CASE I.

Art. **204.** One of the extremes, the ratio, and number of terms being given to find the other extreme.

RULE.

Raise the ratio to a power whose index is equal to the number of terms less 1; *then multiply this power by the first term, and the product will be the last term.*

Ex. 1. If the first term of a series be 4, the ratio 5, and the number of terms 7, what is the last term? *Ans.* 62500

OPERATION.

$(5)^6 = 15625 \times 4 = 62500$ the last term.

2. If the first term of a series be 10, the ratio 20, and the number of terms 5, what is the last term? *Ans.* 1600000.

3. A man purchased a lot of ground containing 15 acres, and agreed to pay for the whole what one acre would come to, allowing 5 cents for the first, 15 cents, and so on to the last; what did the lot cost him? *Ans.* $239,148.45

CASE II.

Art. **205.** To find the sum of all the terms, the first term, the ratio, and the number of terms being given.

Questions.—Art. 202. What is geometrical progression?—Art. 203. What are the terms? What is the rule for Case first? Case the 2nd?

RULE.

Find the last term as in the preceding Case, multiply it by the ratio, and from the product subtract the first term. Then divide this remainder by the ratio less 1, *and the quotient will be the sum of the series.*

Ex. 1. If the first term of a series is 12, the ratio 3, and the number of terms 8, what is the sum of the series? *Ans.* 39,360.

OPERATION.

$3^7 \times 12 = 26244$ the last term : $26244 \times 3 = 78732$:

$78732 - 12 = 78720 \div (3-1) = 39360$, sum of the series.

2. If the first term be 8, the ratio 4, and the number of terms be 7, what is the sum of the series? *Ans.* 43,688.

SECTION LII.

PERMUTATION.

Art. **206.** Permutation is the method of finding how many different ways the order of any number of things, may be varied or changed.

RULE.

Multiply continually together all the terms of the natural series of numbers from 1 *to the given number, and the last product will be the answer.*

Examples for Practice.

1. Four men agreed to dine together so long as they could sit every day in a different order; how many days did they dine together? *Ans.* 24 days.

OPERATION.

$1 \times 2 \times 3 \times 4 = 24$

2. A man bought 9 horses, and agreed to pay for them—1 cent for every different order in which he could place them; what did he pay for them? *Ans* $3628,80

3. A boy bought 6 oranges and agreed to pay for them, 1 mill for every order in which he could place them; what did they cost? *Ans.* 72cts.

4. A certain church has 8 bells; how many changes may be rung upon them? *Ans.* 40,320

SECTION LIII.

DUODECIMALS.

ART. **207.** DUODECIMALS are fractions of a foot, or of an inch, or parts of an inch.

This rule is used by artificers and others, to measure their work. The foot is divided into 12 parts, called *inches*, each of which are divided again into 12 parts called *seconds;* and each of the seconds, into 12 parts called *thirds;* and each third into 12 parts, called *fourths.*

ART. **208.** TABLE OF DENOMINATIONS.

12 Fourths,	marked,	⁗,	make	1 third.
12 Thirds,	"	‴,	"	1 second.
12 Seconds,	"	″,	"	1 inch.
12 Inches,	"	in.	"	1 foot. Ft.

ART. **209**. ADDITION OF DUODECIMALS.

RULE.

Add as in Compound Addition, carrying 1 *for each* 12 *to the next higher denomination.*

EXAMPLES FOR PRACTICE.

		1.					2.		
14ft.	4in.	3″	5‴	6⁗	28ft.	4in.	6″	1‴	10‴
85	7	8	6	6	15	6	7	0	9
56	10	1	2	0	35	6	1	6	2
156	10	1	2	0 *Ans.*					

QUESTIONS.—Art. 207. What are duodecimals? By whom are they used? How are the feet, &c., divided?—Art. 208 Repeat the table. Art. 209 What is the rule for the addition of duodecimals?

3. Five floors in a certain building contain each, 1295ft. 9in. 3''; how many feet in the whole? *Ans.* 6478ft.10in. 3''

ART. 210. SUBTRACTION OF DUODECIMALS.

RULE.

Work as in Compound Subtraction, borrowing from 12, *when necessary.*

EXAMPLES FOR PRACTICE.

	1.					2.				
From	176ft.	1in.	2''	6'''	10''''	4786ft.	10in.	1''	6'''	7''''
Take	97	10	1	7	11	987	8	11	6	9
Ans.	78	3	0	10	11					

ART. 211. MULTIPLICATION OF DUODECIMALS.

RULE.

I. *Write the multiplier under the multiplicand, with feet under feet, inches under inches, &c.*

II. *Multiply each term in the multiplicand, beginning at the lowest, by the feet of the multiplier, and write the product under its respective term; observing to carry one for every* 12, *from each lower denomination to the next higher.*

III. *Multiply in the same manner with the inches, and set the product of each term, one place further to the right hand, and carry one for every* 12, *as before.*

IV. *Work in the same manner with the second, &c., and the sum of the whole will be the answer.*

NOTE.—Feet multiplied by inches gives inches; and feet multiplied by seconds gives seconds, &c.

EXAMPLES FOR PRACTICE.

1. Multiply 5ft. 4in. by 6ft. 8in. and 6ft. by 6in. 2''

OPERATION.

1.			
	5ft.	4in	
	6	8	
	32	0	
	3	6	8''
Ans.	35	6	8''

2.			
	6ft	0in.	0''
		6	2
	3	0	0
	0	1	0
Ans.	3	1	0

2. A floor 79ft. 8in., by 8ft. 11in.; how many feet does it contain? *Ans.* 710ft. 4in. $4''$

3. A mahogany board measures 28ft. 10in., by 3ft. 2in. $4'$; what does it contain? *Ans.*

SECTION LIV.

POSITION.

ART. **212.** POSITION is a rule for finding an unknown number by one, or more supposed numbers: it is either *single* or *double.*

ART. **213.** SINGLE POSITION teaches the method of solving such questions as require only one supposed number.

RULE.

Work with the supposed number, according to the tenor of the question. Then say,

As the result of that operation, is to the supposed number. so is the given number to the answer.

Ex. 1. A person after spending ⅓ and ¼ of his money had $60 left; what had he at first? *Ans.* $144

OPERATION.

Suppose 24; then ⅓ of 24=8 and ¼ of 24=6 and 8+6=14.
24—14=10; then 10 : 24 : : $60 : $144.

2. What sum is that, of which ¼, ⅕ and ⅙ will make $74? *Ans.* $120.

3. The principal of a school being asked how many pupils he had, answered: if to double the number I add ½, ⅓, and ¼ of them, I shall have 333; how many had he? *Ans.* 108.

4. What sum at 6 per cent. per annum will amount to $560, in 10 years? *Ans.* $350.

NOTE.—Double Position teaches the method of solving questions by taking two supposed numbers. Neither of the above rules, however

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QUESTIONS.—Art. 212. What is Position?—Art. 213. What does Single Position teach? What is the rule? What does Double Position teach? By what rule may the questions in Position be more readily solved?

properly belong to arithmetic; the questions under them may be much more easily and readily solved by the rule for simple equations in algebra. It is not, therefore, deemed necessary to give any examples in double position, in this work.

MISCELLANEOUS EXERCISES.

1. If 9 bushels of wheat cost \$13.50, what is it per bush.? *Ans.* \$1.50.

2. At 50cts. per bushel how many bushels can I buy for \$24? *Ans.* 48 bushels.

3. How many bushels of potatoes, at 1s. 6d. per bushel, can I buy for 20£.? *Ans.* 266⅔ bush.

4. At what time will any sum of money double itself at 6 per cent. simple interest? *Ans.* 16 years, 8mo.

5. What is the difference between 6 dozen dozen and half a dozen dozen? *Ans.* 792.

6. What must be paid for 3/16 of a ship, valued at \$3360? *Ans.* \$630

7. A room 30 feet long and 18 wide, is to be covered with oil cloth; how many yards ¾ wide will cover it? *Ans.* 80yds

8. Loaned a friend \$700, which he kept 20 months. I borrowed of him \$300; how long should I keep it to balance the favor? *Ans.* 46⅔ months.

9. How many variations may there be in the position of nine digits? *Ans.* 362,880

10. How many bushels of wheat, at \$1.50 per bushel must be given in exchange for 84 yards of cloth at \$1.25? *Ans.* 70 bushels

11. What number is that of which 9 is the ⅔ part? *Ans.* 13½.

12. If 40 sheep cost \$100, what was that per head? *Ans.* \$2.50.

13. If 3 bushels of oats cost 7s. 6d., how much is it per bushel? *Ans.* 2s. 6d.

14. If 7 men can eat 28lbs. of meat in one week, how much did each man eat? *Ans.* 4lbs.

15. What is the interest on \$154.01, for 2 years, 4 months and 3 days, at 5 per cent.? *Ans.* \$18.03,2

16. Suppose a book to contain 365 pages, averaging 40 lines, of 10 words each, per page. How many words would the book contain? *Ans.* 146000.

17. If I sell cloth at $1.50 per yard, and gain 25 per cent., how ought I to have sold it so as to lose 20 per cent.? *Ans.* $0.96.

18. If I buy cloth at $1.20 per yard, how must I sell it to gain 25 per cent? *Ans.* $1.50.

19. What is the present worth of a note for $6720, discounted at bank, payable in 90 days, at 7 per cent? *Ans.* $6598.48.

20. A man gave $\frac{1}{7}$ of a pound for a hat, $\frac{1}{3}$ of a shilling for thread, and $\frac{1}{2}$ of a penny for a needle. What did they all amount to. *Ans.* 3s. 2d. 3$\frac{1}{7}$far.

21. If a person travel 8 miles in 10 hours, how far will he travel in 5 days by travelling 8 hours each day? *Ans.* 32m.

22. If 27$\frac{1}{2}$ yards of cloth cost $60, how many yards can I buy for $100? *Ans.* 45$\frac{5}{6}$yds.

23. If $\frac{5}{8}$ of a house be worth $9000, what is the whole worth? *Ans.* $14,400

24. If a vessel can sail 3000 miles in 14 days, how long will it require it at that rate to sail 24,900 miles? *Ans.* 116$\frac{1}{5}$d.

25 If it require 30 yards of carpeting $\frac{3}{4}$ of a yard wide to cover a room, how many yards 1$\frac{1}{4}$ yard wide will it take to cover the same room? *Ans.* 18yds.

26. If the diameter of the earth be 8000 miles, and the loftiest mountain 5 miles high, what elevation must be made on a globe of 16 inches in diameter to represent accurately the height of such a mountain? *Ans.* $\frac{1}{100}$ of an inch.

27. If 15 men working 10 hours per day, can, in 18 days. build 450 yards of a stone wall, how many men, working 12 hours each day for 8 days will be required to build 480 yards of a similar wall? *Ans.* 20 men.

28. What is the sum of $\frac{2}{3}$ of a week, $\frac{1}{5}$ of a week, and $\frac{1}{3}$ of an week? *Ans.* 8d. 9h. 36min.

29. In 25 years and 6 hours, how many seconds? *Ans.* 789,458,400.

30. What must be the amount of a bankable note, that, when discounted for 3 months at 6 per cent. it will be worth $600? *Ans.* $609.446+.

31. A farmer raised 1097 bushels of wheat; gave 10 per cent. for threshing it, and 10 per cent. of the remainder for grinding it into flour; what per cent. of the whole has he left? *Ans.* 81 per cent.

32. How many men must be employed to do in 26 days what 60 men could do in 39 days. *Ans.* 90 men.

33. What is the difference between six and a half times 7 and seven and a half times 6? *Ans.* $\frac{1}{2}$.

34. How many yards of carpeting $\frac{3}{4}$ of a yard wide will be required to cover a floor 18 by 29 feet. *Ans.* 77$\frac{1}{3}$yds.

35. If a pole 7 feet long cast a shadow of 5 feet, how high is a steeple that at the same time casts a shadow 97 feet? *Ans.* 135$\frac{4}{5}$ft.

36. If 4 gallons of vinegar be worth 7 gallons of cider, how much vinegar will I exchange for 47 gallons of cider? *Ans.* 26$\frac{6}{7}$ gal.

37. If 5 compositors in 16 days, 11 hours long, can compose 25 sheets of 24 pages in each, and 44 lines to the page, and 40 letters to the line, in how many days, 10 hours long, may 9 compositors compose a volume to be printed on the same letter, consisting of 36 sheets, 16 pages to the sheet, 50 lines to a page, and 45 letters to the line? *Ans.* 12 days.

38. If I buy cloth for $4 and sell it at $5 per yard, what per cent. do I gain? *Ans.* 25 per cent.

39. If a man sell cloth at $5 per yard, and thereby make 25 per cent. what was the prime cost of the cloth? *Ans.* $4.

40. If a certain room be 20 feet long, 16 feet wide and 12 feet high; how long must a line be to extend from one of the lower corners to be opposite an upper corner. *Ans.* 28.28+ feet.

41. What is the value of 17 acres, 3 rods, and 35 perches of land at $80 per acre. *Ans.* $1437.50.

42. A grocer mixed 2cwt. of sugar at $9.00 per cwt. and 1cwt at $7.00 per cwt. and 2cwt. at $10.00 per cwt.; what is the value of 1cwt. of the mixture? *Ans.* $9.00.

APPENDIX.

SECTION I.

MENSURATION OF SURFACES.

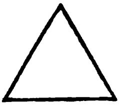
Art. 1. A **Surface** is a magnitude, which has length and breadth without thickness. The superficial contents of any figure is called its *area.*

Art. 2. An **Angle** is the inclination or opening of two lines, which meet in a point.

A *Right Angle* is an angle formed by one line falling perpendicularly on another, and contains 90 degrees.

An *Acute Angle* is an angle less than a right angle, or less than 90 degrees.

An *Obtuse Angle* is an angle greater than a right angle, or more than 90 degrees.



A *Triangle* is a figure having three sides and three angles. A line let fall perpendicularly from any one of its corners on the opposite side, is called the *Altitude* of the triangle, and the line on which it falls, the *Base.*

Art. 3. To find the area of a triangle, the base and altitude being given.

Rule.—*Multiply the base by one half the altitude, and the product will be the area.*

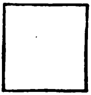
Ex. 1. What is the area of a triangular yard, the base 60 feet and altitude 30 feet? *Ans.* 900 feet.

OPERATION.

$30 \div 2 = 15$ half the altitude. $60 \times 15 = 900$ft. the area.

2. What is the area of a triangle, whose base is 14 inches and altitude 20 inches? *Ans.* 140 inches.

3. What is the contents of a triangular field, the base being 60, and the altitude 50 rods? *Ans.* 1500 rods.



Art. **4.** A *Square* is a figure which has all its sides equal, and its angles right angles.

A *Rectangle* is a figure with all its angles right angles, not having its sides equal.

A *Rhomboid* is an oblique figure, whose opposite sides are equal.

Art. **5.** To find the area of a *Square, Rectangle* or *Rhomboid*, we have the following

Rule.—*Multiply the base by the altitude, and the product will be the area.*

Ex. 1. What is the area of a square, the side of which is 12 feet? *Ans.* 144 feet.

OPERATION.

$12 \times 12 = 144$ feet.

2. What is the contents of a board 20 feet long and 1½ft. wide? *Ans.* 30 feet.

3. What is the difference between the contents of 2 floors; the one 16 feet square, and the other 24 feet by 15? *Ans.* 104 feet.

4. What is the area of a rhomboid, the base being 15 feet and the altitude 9? *Ans.* 135 feet

Art. **6.** To find the area of a *Trapezoid*, a figure which has two of its opposite sides equal.

Rule.—*Multiply half the sum of the parallel sides by the altitude, and the product will be the area.*

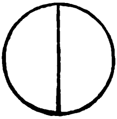
Ex. 1. What is the area of a board, the length of which is 22 feet, the wider end 18 inches, and the other 14?

OPERATION.

$22 \times 12 = 264$in.$\times 16 = 4224$in.$= 29$ feet 4 inches.

$18 + 14 = 32 \div 2 = 16$ the half sum.

2. What is the area of a trapezoid, the longer parallel side being 95 yards and the shorter 63 yards, and the altitude 30 yards? *Ans.* 2,370yds.



ART. **7.** A *Circle* is a plain figure bounded by a curved line, every part of which is equally distant from a point, called the centre. The *Circumference* of a circle is the line which bounds it. The *Diameter* is a line drawn through the centre.

ART. **8.** To find the circumference of a circle, the diameter being given.

RULE.—*Multiply the diameter by* 3.1416, *and the product will be the circumference.*

Ex. 1. What is the circumference of a wheel, whose diameter is 20 feet? *Ans.* 62.832 feet.

$$20\times3.1416=62.832\text{ft.}$$

2. There is a circular yard 25 feet in diameter, what is the length of the fence necessary to enclose it? *Ans.* 78.54ft.

ART. **9.** To find the diameter, the circumference being given.

RULE.—*Divide the circumference by* 3.1416, *and the quotient will be the diameter.*

Ex. 1. What is the diameter of a circle, the circumference being 20 feet? *Ans.* 6.36 feet.

$$20\div3.1416=6.42+\text{ the diameter.}$$

2. What is the diameter of a circle, the circumference being 50 feet? *Ans.* 15.9+ feet.

ART. **10.** To find the area of a circle, the diameter, the circumference, or both being given.

RULE.—*Multiply the circumference by half the radius. Or Multiply the square of the radius by* 3.1416.

NOTE.—The *radius* of a circle is half its diameter.

Ex. 1. What is the area of a circle, whose diameter is 8 and circumference 25.128 feet? *Ans.* 50.256.

2. How many square yards in a circle, whose diameter is 16 feet? *Ans.* 22.34 yards.

3. How many square perches in a circular field, which measures 64 perches in diameter? *Ans.* 3217 per. nearly

4. A man tied his horse in a field to a stake, with a rope 25 yards long; over how many square yards of pasture would the rope allow the horse to graze? *Ans.* 1963.5yds

Art. **11.** To find the side of a square equal in area to a given circle.

Rule.—I. *Multiply the diameter by* .8862, *and the product will be the side of an equal square.* *Or,*

II. *Multiply the circumference of the circle by* .2820, *and the product will be the side of a square, whose area will be equal to that of the circle.*

Ex. 1. There is a circular garden 30 feet in diameter; what is the side of a square that will contain the same quantity? *Ans.* 26.586 feet.

$.8862 \times 30 = 26.586$ feet.

2. A man has a circular field 100 perches in circumference; what must the side of a square field be that will contain the same area? *Ans.* 28.2 perches.

3. The bottom of a circular vessel is 15 inches in diameter; what must be the side of a square that will contain the same area, and what will be the area of the square?

Ans. 13.293 side of square; 176.703+.

Art. **12.** To find the area of an *Ellipsis.*

An Ellipsis is an oval figure having two diameters, the longer called the *transverse,* and the shorter the *conjugate* diameter.

Rule.—*Multiply half the sum of the two diameters together, and their product by* 3.1416, *the last product will be the answer.*

Ex. 1. Require the area of an ellipsis whose axes are 24 and 18 feet? *Ans.* 339.2928.

2. In a certain yard there is an elliptical plat of ground, measuring 75 feet by 49; how many feet of square sods will be required to cover it? *Ans.* 192.243.

SECTION II.

MENSURATION OF SOLIDS.

Art. **13.** A Solid is a magnitude that has length, breadth and thickness. The mensuration of solids consists of two operations; first, to find their superficial contents, and then their solidities.

ART. **14.** A PRISM is a solid, whose ends are any plane figures which are equal and similar. To find the surface of a Prism.

RULE.—*Multiply the perimeter of the base by the altitude; and to the product add the two ends; the sum will be the area of the prism.*

Ex. 1. What is the superficial contents of a square prism, the side being 5 feet and altitude 20 feet? *Ans.* 450ft

Perimeter 20 × 20 altitude = 400
5 × 5 = 25 × 2 = 50 area of the ends.

450 sup. contents.

2. What is the area of a triangular prism, the length of each side being 6, altitude 5, and the altitude of the prism being 15 feet? *Ans.* 288 feet.

2. How many square feet of tin will be sufficient to line a cistern measuring 3 feet square? *Ans.* 54 feet.

ART. **15.** To find the solidity of a Prism.

RULE.—*Multiply the area of the base by the altitude.*

Ex. 1. What are the contents of a triangular prism, the area of the base being 9 feet and altitude 10 feet? *Ans.* 90ft.

2. How many cubic feet in a block of marble 2½ feet square? *Ans.* 15.62.

3. How many square yards of earth must be dug out of a cellar 30 feet long, 15 wide, and 6½ deep? *Ans.* 108⅓.

ART. **16.** A CYLINDER is a long circular figure of uniform diameter, and its extremities forming equal circles.

To find the surface of a Cylinder.

RULE.—*Multiply the circumference of the base by the altitude, and to the product add the area of the two bases, the sum will be the whole surface.*

Ex. 1. What is the entire surface of a cylinder, whose length is 6 feet, and the diameter of the base 4 feet? *Ans.* 100.558.

2. How many feet of tin will be sufficient to cover a cylin

drical column, whose altitude is 20 feet, and circumference of the base 4 feet? *Ans.* 80 feet.

Art. **17.** To find the solidity of a Cylinder.

Rule.—*Multiply the area of the base by the altitude, and the product will be the solidity.*

Ex. 1. How many solid feet in a column of granite 15ft. in length and 3.5 in diameter at either base? *Ans.* 144.317+.

2. What is the solidity of a cylinder, whose altitude is 10 feet and the circumference of the base 5 feet? *Ans.* 19.894+.

PYRAMID AND CONE.

Art. **18.** A Pyramid is a solid standing on a triangular, square, or polygonal base, and having its sides triangular and meeting at the top, called the *vertex.*

A Cone is a solid, having a circle for its base, and its top terminated in a point, also called the *vertex.* The *altitude* of a pyramid and of a cone, is a line drawn from the vertex perpendicular to the plane of the base.

The *slant height* of a pyramid is a line drawn from the vertex to the middle of one of the sides of the base; and the *slant height* of a cone is a line drawn from the vertex to the circumference of the base.

Art. **19.** To find the surface of a Pyramid or Cone.

Rule.—*Multiply the perimeter or the circumference of the base by half the slant height, and the product will be the surface; add to this the area of the base, if required, and the sum will be the entire surface.*

Ex. 1. What is the surface of a triangular pyramid whose slant height is 18 feet, and each side of the base 4 feet? *Ans.* 108 feet.

2. What is the entire surface of a pyramid, whose base is 3 feet square, and slant height 20 feet? *Ans.* 129 feet.

3. What is the surface of a cone, whose slant height is 50 feet, and circumference of the base 12 feet? *Ans.* 300ft.

4. How much paper will it take to cover a loaf of refined sugar, 25 inches in circumference at the base, and the slant height 18 inches? *Ans.* 1½ feet nearly

ART. **20.** To find the solidity of a Pyramid or Cone.

RULE.—*Multiply the area of the base by one third of the altitude, and the product will be the solidity.*

EX. 1. What is the solidity of a square pyramid, each side of the base being 6ft. and the altitude 18ft. *Ans.* 216ft.

2. What is the solidity of a cone, the diameter of the base being 10 inches and the altitude 50 inches? *Ans.* 130.9in.

ART. **21.** The *Frustrum* of a pyramid or cone, is that part next to the base that remains after cutting off the top by a plane parallel to the base.

To find the surface of a frustrum of a pyramid or cone.

RULE.—*Add the perimeter or the circumference of the two ends together, and multiply this sum by half the slant height Then add to this product, if required, the area of the two ends and the sum will be the entire surface.*

EX. 1. How many square feet in the surface of the frustrum of a square pyramid, whose height is 10 feet, and each side of the lower base 4 feet, and each side of the upper base 2ft.? *Ans.* 120.

2. The Merchants' Shot-tower on Front street is built in the form of the frustrum of a cone; the height of the tower is 250 feet, the diameter of the lower base is 40 feet, and the diameter at the top 20 feet. How many square feet of tin would be sufficient to cover it? *Ans.* 47,124.

ART. **22.** To find the solidity of the frustrum of a pyramid or cone.

RULE.—*Find the area of the two bases of the frustrum; multiply these together, and extract the square root of the product. To this root add the two areas, and multiply the sum by one-third of the altitude of the frustrum, the product will be the solidity.*

EX. 1. What is the solidity of the frustrum of a square pyramid, the height being 12 feet, and each side of the lower base 4ft., and each side of the upper base 2ft.? *Ans.* 112.

2. A certain farmer has a churn 3½ feet high, the lower diameter inside 2 feet, the upper diameter 1 foot; how many gallons of milk will it hold? *Ans.* 39 gal. 1 qt +

NOTE.—The milk gallon contains 282 cubic inches.

ART. **23.** A SPHERE is a solid bounded by one continued convex surface, every part of which is equally distant from a point called the *centre.*

To find the convex surface of a sphere.

RULE.—*Multiply the diameter by the circumference, and the product will be the surface.*

Ex. 1. What is the surface of the earth, the diameter being 8000 miles? *Ans.* 201061888 square miles.

2. How much leather will be sufficient to cover a ball 1¼ inches in diameter? *Ans.* 7.068.

ART. **24.** To find the solidity of a sphere.

RULE.—*Cube the diameter, and multiply it by* .5236.

Ex. 1. What is the solidity of a sphere, whose diameter is 3 feet? *Ans.* 14.1372.

2. If the diameter of a globe be 5 feet, how many cubic feet does it contain? *Ans.* 65.45.

ART. **25.** To find how many solid feet a round stick of timber will contain, when hewed square.

RULE.—*Multiply twice the square of its semi-diameter in inches by the length in feet, then divide the product by* 144, *and the quotient will be the answer.*

Ex. 1. If the diameter of a round stick of timber is 20in. and its length 16 feet, how many solid feet will it contain when hewed square? *Ans.* 22.22.

$$10 \times 10 \times 2 \times 16 \div 144 = 22.22 \text{ feet.}$$

2. How many square feet of timber in a round stick measuring 18in. in diameter and 22ft. in length? *Ans.* 27.8.

ART. **26.** To find how many feet of square edged boards of a given thickness can be sawed from a log of a given diameter.

RULE.—*Find the solid contents of the log when made square, by the last article; then say, As the thickness of the board is to the solid feet, so is* 12 *to the number of feet of boards.*

Ex. 1. How many feet of square edged boards, 1 inch thick, may be sawed from a log 20 feet long and 24 inches in diameter? *Ans.* 480.

2. How many feet of square edged boards 1¼ inches thick can be sawed from a log 18 feet long and 24 inches in diameter? *Ans.* 288 feet.

ART. **27.** The dimensions of any kind of a rectangular vessel being given, to find how many bushels it will contain.

RULE.—*Multiply the length, breadth and depth together, and divide the product by* 2150.42, *the number of cubic inches in a bushel, and the product will be the answer.*

Ex. 1. How many bushels will a box contain that measures in the inside 4 feet in length, 3 feet in width, and 2.5 deep? *Ans.* 24 bush.+

2. How many bushels of oats will a certain box contain, that measures 5 feet square at the bottom, and 8 feet in height? *Ans.* 160 bush. 3 pecks.

ART. **28.** To find the tonnage of a ship.

RULE.—*Multiply the length of the keel by the breadth of the beam, and the product by the depth of the hold, and divide the product by* 95, *the quotient will be the tonnage.*

Ex. 1. Suppose the keel of a ship to be 72 feet, the beam to be 24 feet, and the depth 12 feet; what is the tonnage?

$$72 \times 24 \times 12 \div 95 = 218.2+ \text{ tons. } \textit{Ans.}$$

2. The keel of a ship is 150 feet, the beam 40, and the depth 25 feet; what is the tonnage? *Ans.* 1576.84 tons.

ART. **29.** To measure a brick wall, the dimensions being given.

RULE.—*Multiply the length of the wall by the height, and that product by the number of bricks in a square foot of the wall; the last product will be the whole number of bricks in the wall.*

NOTE.—*Seven* bricks are generally allowed to the square foot in a wall of a single brick in thickness; 14 bricks to a wall of nine inches; 21 bricks to a fourteen inch wall, &c.

In measuring a house, the different walls may be measured separately, the sum of the whole will be the number of bricks in the house, after deducting the openings for the doors and windows; these openings are not usually deducted, being more generally allowed for the fire-places and chimneys.

Ex. 1. How many bricks in a wall 25 feet long, 6 high, and 9 inches thick? *Ans.* 2100.

$$25 \times 6 \times 14 = 2100 \text{ bricks.}$$

2. How many bricks will be sufficient to build a house 15 feet front, 30 deep, 27 high, and pitch of the roof 6 feet, the walls being 9 inches thick? *Ans.* 36,540.

3. How many bricks in a division wall 28 feet by 25, the wall being one brick thick? *Ans.* 2800

BOOK-KEEPING.

Book-keeping is a mercantile term used to denote the method of keeping accounts, in such a manner that a person may at any time know the true state of his affairs. Every person, engaged in business for himself, should keep a book in which to record all his business transactions; and no one should trust transactions of a pecuniary nature to his memory alone.

The following system will be found most convenient for farmers, mechanics, and for persons in the retail store business. It is so plain that a person of ordinary capacity may acquire a knowledge of it in a few lessons. It is intended to do away with the use of the day-book separate from the ledger; and consequently, the tedious process of posting from one book to the other.

To commence book-keeping according to this system, let a person procure a blank book, ruled similar to the following pages, with the letters Dr. for *debtor*, over the left hand column for dollars and cents, and Cr. for *creditor*, over the right hand column.

Then when a person buys any article on credit, enter the article with the price under his name, and place the amount in the column marked Dr. Again, when any payment is made either in cash, merchandise, or by note, make the entry as before, and place the amount in the column marked Cr.

In order to balance the accounts, it is only necessary to add up the columns of Dr. and Cr., the difference between them will be the balance. An *index* of the names should be kept in the beginning of the book.

M. J. KERNEY. *DR.* *CR.*

1849.		*DR.*		*CR.*	
Jan. 1	To 3 barrels family flour, at $7,	$21	00	$	
"	1 chest Y. H. Tea, 26lbs. at 50 cts. per lb.	13	00		
"	14lbs. butter, at 25 cts. per lb.	3	50		
"	25lbs. crackers, at 10 cts. per lb.	2	50		
Jan. 8	15lbs. brown sugar, at 7 cts. per lb.	1	05		
"	10lbs. cheese, at 12½ cts. per lb.	1	25		
"	5 gal. Malaga wine, at 87½ cts.	4	37½		
Jan. 15	By cash on account			25	00
"	To 50lbs. St. Domingo coffee, at 12½ cts. per lb.	6	25		
Jan. 20	15lbs. candles, at 10 cts. per lb.	1	50		
"	1 keg butter, weight 28lbs. at 25 cts. per lb.	7	00		
Jan. 25	4 gal. molasses, at 37½ cts.	1	50		
"	5 gal. wine, at $1.50 per gal.	7	50		
"	1 box raisins, weight 35lbs., at 12½ cts. per lb.	4	37½		
"	By cash on account,			20	00
Jan. 28	To 3lbs. ground pepper, at 40 cts. per lb.	1	20		
"	15lbs. sugar, at 7 cts. per lb.	1	05		
"	12lbs. soap, at 11 cts. per lb.	1	32		
Feb. 1	By cash on account,			10	00
"	To 2 barrels family flour at $7,	14	00		
"	20lbs. lard, at 10 cts. per lb.	2	00		
"	1 peck salt,	0	30		
Feb. 10	14lbs. butter, at 22 cts. per lb.	3	08		
"	15lbs. bacon, at 12½ cts. per lb.	1	87½		
Feb. 15	By cash on account,			10	00
Feb. 18	To 10lbs. coffee, at 10 cts. per lb.	1	00		
"	5lbs. starch, at 12½ cts. per lb.	0	62½		
Feb. 25	15lbs. sugar, at 6¼ cts. per lb.	0	93¾		
		102	18¾	65	00
Mar. 1	By cash in full,			37	18¾
		102	18¾	102	18¾

WILLIAM SMITH.

			DR.		CR.	
1849.						
Jan.	14	To 14yds. superfine cloth, at $5 per yd.	$70	00		
"		1 piece muslin 29½yds. at 12½ cts per yd.	3	68		
"		2 doz. buttons, at 50 cts. per doz.	1	00		
Jan.	20	25yds. calico, at 14 cts. per yd.	3	50		
"		5yds. cambric, at 15 cts. per yd.	0	75		
Jan.	25	By cash on account,			$75	00
"		To 25yds. cloth, at $2.50 per yd.	62	50		
"		20yds. carpeting, at 87½ cts.	17	50		
Feb.	1	By cash in full,			83	93
			158	93	158	93

JOHN ROBERTS.

Jan.	25	To 25bush. of wheat, at $1.12½ per bushel,	$28	12½		
"		20bu. rye, at 75 cts. per bush.	15	00		
"		By cash on account,			20	00
Jan.	29	To 35bu. potatoes, at 80 cts. per bu.	28	00		
"		75bu. oats, at 40 cts. per bush.	30	00		
"		5 cords wood. at $3.50 per cord,	17	50		
Feb.	3	By cash on account,			25	00
"	8	To 80bu. wheat, at $1.10 per bu.	88	00		
"		20bu. corn. at 62½ cts. per bu.	12	50		
"	15	55bu. wheat, at $1.06¼ per bu.	58	43¾		
"		25bu. oats, at 38 cts. per bu.	9	50		
Mar.	1	By cash on account,			75	00
"	5	To 75bu. wheat, at $1.10 per bu.	82	50		
"	10	50bu. corn, at 75 cts. per bu.	37	50		
"	20	25bu. oats, at 40 cts. per bu.	10	00		
"		15bu. potatoes, at 87½ cts. per bu.	13	12½		
			430	18¾	120	00
Ap'l	10	By note at 60 days for the balance,			310	18¾
			430	18¾	430	18¾

		HENRY MASON.	DR.		CR.	
1849.						
April		To 25lbs. flour, at 3½ cts. per lb.	$0	87½		
"		4lbs. sugar, at 6¼ cts. per lb.	0	25		
"		5lbs. bacon, at 10 cts. per lb.	0	50		
"	8	1 gallon molasses,	0	37½		
"		1 quart vinegar,	0	12½		
"		2lbs. butter, at 20 cts. per lb.	0	40		
"		1 peck salt,	0	25		
"	15	By cash on account,			$2	00
			2	77½		
			2	00		
"		Balance,	0	77½		
"	20	To 1lb. butter,	0	20		
"		8lbs. sugar, at 7 cts. per lb.	0	56		
"		5lbs. candles, at 11 cts. per lb.	0	55		
"	25	25lbs. flour, at 3 cts. per lb.	0	75		
"		3lbs. soap, at 10 cts. per lb.	0	30		
"		1 gallon molasses,	0	37½		
May	1	By cash in full,			3	51
			$3	51	$3	51

COMMERCIAL FORMS.

A Bill of Purchase.

Baltimore, May 1*st*, 1849.

James Fulton,

Bought of J. W. Bond & Co.

50 dozen Copy-books, at $1.00,	$50.00
10 dozen Walker's Dictionary, at $2.50,	25.00
5 dozen Mitchell's Geography & Atlas, at $10.00,	50.00
1 pound Wafers,	1.00
	$126.00

Received payment,

J. W. Bond & Co.

Promissory Note.

$100. *Baltimore, June* 10*th*, 1849.

Ninety days after date, I promise to pay J. H. Hanson, or order, one hundred dollars. Value received.

PETER PAYWELL.

RECEIPTS.

A Receipt in Full.

$160. *Richmond, May* 15*th*, 1849

Received of C. D. Sixty Dollars, in full of all demands against him.

A. JONES.

A Receipt for Money on Account.

Received, Baltimore, May 10th, 1849, from Samuel Cox. Thirty Dollars on account.

$30.00. WILLIAM SMITH.

A Receipt for Rent.

Received, Baltimore, July 6th, 1846, of A. B. Twelve Dollars and Fifty Cents, in full for one month's house rent due the 1st instant.

$12.50. THOMAS GOUGH

DUE BILL.

Due Henry Staylor, or order, Fifty Dollars and Seventy-five Cents. Value received.

$50.75. CHARLES L. BOYD.

July, 1871.

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***Modern History**; from the Coming of Christ, and the Change of the Roman Republic into an Empire, to the Year of our Lord,* 1867. By PETER FREDET, D. D, Professor of History in St. Mary's College, Balt. 26th revised and enlarged edition. 12o., half arab. 1 50

Introduced into many of the principal Literary Institutions of the United States, adopted as Text Books in the Irish University, Dublin, and many Institutions in England and the Provinces, Fredet's Histories have acquired a widespread reputation, and their excellence is too well established, at this day, to be dwelt upon. The publishers have the pleasure of announcing, that, in order to make the Modern History more complete and deserving of the liberal patronage hitherto extended to it, they have, with the valuable assistance of the late Dr. Fredet's reverend collaborators, added several Chapters embracing the Historical Events that have taken place in this and other countries from 1854 to 1867.

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☞ *From a large number of Commendatory Notices of Professor Fredet's Ancient and Modern Histories, we select the following, as embodying the spirit of all.*

COLLEGE OF WILLIAM & MARY, *Williamsburg, Va., October*, 1867.

GENTLEMEN:—The demand for Fredet's Ancient and Modern Histories and Kerney's Compendium of History, shows that these most excellent books are appreciated as they ought to be. The improvements and additions to the editions of 1867 just issued from your press, make them all that could be reasonably desired. Immediately after the reopening of the College of William and Mary, in 1865, Fredet's Histories were, after a careful examination of the Text Books of the day, adopted in the Institution. A more intimate acquaintance soon justified the wisdom of the selection. They evidently were written in a conscientious and Christian spirit, with a manifest intent to teach historical truths. They constitute an honorable monument to the memory of the late Reverend Author,

Kerney's Compendium was subsequently introduced into the College Grammar School, and gave entire satisfaction. In style and system and the interest it excites, it is admirably adapted to beginners and junior students, while it may be read and consulted with profit by the more advanced. Trusting that your public spirit and enterprise in putting such standard works within reach may meet with a liberal encouragement. I remain yours, very respectfully,

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NOTICES OF THE PRESS.

The Metropolitan, in noticing this work, says:—"We are glad to see this excellent abridgment adapted to the use of schools. It will do much to remove those many false impressions, which English historians have hitherto made upon the readers of history by their word-painting of imaginary events. In no nation perhaps was history more 'a conspiracy against truth,' than in that of England, and in none did the mind of American youth need a more particular antidote to its poisoning influence. It was a good thought then to give a sound, reliable first book to the youthful student, and we are happy to find that Mr. Burke and his able American collaborator, have succeeded in producing a text-book which we can with the utmost confidence commend to the favorable consideration of the instructors of youth.

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OPINIONS OF THE PRESS.

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This Book, has been Introduced into the Female High Schools of Baltimore, by the following Resolutions, January 10, 1871.

Resolved, That the Committee on Female High Schools be authorized to purchase for, and introduce into said Schools as a Text-book on general History, Kerney's Compendium of History.

Resolved, That from and after this the use of all other Histories as Text-books in said Female High Schools shall be forbidden and the book adopted under the authority of the foregoing resolutions shall be substituted in the place of those now used and taught in said Schools.

Baltimore City College, *Baltimore, May 31st,* 1871.

Messrs. Murphy & Co. In accordance with your request, I have carefully examined Kerney's Compendium of History. As the result of this examination, I can unhesitatingly affirm that the work is uniformly pervaded by a clear, candid, and discriminating narrative of leading historical events, which admirably adapt it to the purposes of instruction in our Schools and Academies. A second and a more diligent perusal of the book, has only served to confirm my first impressions of its excellence, and I commend it to all who are interested in elevating the standard of instruction in this most important department of our educational system.

Henry E. Shepherd, *Prof. History and Literature.*

Eastern Female High School, *Baltimore, June* 20, 1871.

Gentlemen: I have no cause to change the favorable opinion I expressed of "Kerney's Compendium of Ancient and Modern History" on its introduction into this School. In the hand of the true educator it has, I think, no superior. Nath. H. Thayer.

Kerney's Compendium has been introduced into the College Grammar School, and gives entire satisfaction. In style and system, and the interest it excites, it is admirably adapted to beginners and junior students, while it may be read and consulted with profit by the more advanced.

Benj. S. Ewell, *President.*

Williamsburg, Va., *October,* 1867. *College William and Mary.*

The Compendium of History, by M. J. Kerney, has been in my possession several months, and, after a careful reading, I believe it to be a very useful book in the department of study to which it belongs. I take pleasure in recommending it to teachers.

J. N. M'Jilton, *Chairman Central High School of Balt.*

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The appearance of thirty-two large editions of Kerney's First Class Book of History within *twenty* years, is a sufficient evidence of its popularity as an elementary class book. As a book for study, and a book for reading, in place of the disjointed matter found in ordinary "Readers," the publishers have endeavored to make it every way worthy of continued patronage.

The importance of the particular changes introduced in this edition, renders it desirable to call the attention of teachers and parents to its enhanced value. Errors and inaccuracies of whatever kind have been carefully rectified. If any have found in it heretofore defects worthy of notice, it is to be hoped that the emendations supplied,—suggested as they have been, by teachers of experience,—will recommend this new edition to their hearty approval.

In order to make this book correspond in character with the Author's larger work, the "Compendium of Ancient and Modern History," the last edition was enlarged by the introduction of a short synopsis of Sacred and Ancient History. In Modern History, several chapters were added, embracing the most important recent events that had transpired in the civilized countries of the world, including the late "American Civil War."

The form of "Questions" at the foot of each page has been improved. Superfluities have been retrenched, and facts equally as important to be known as those already stated, introduced. Where the narrative embraces events, which, from their religious or political bearing, gives rise to a diversity of opinion among men, care has been taken to avoid a method of statement likely to prove offensive to either extreme. *Truth* is the object aimed at, not partizanship: in the interests of which it is notorious that the most of what is called History, is written. The publishers trust that this little book will now find its way into a still wider circle of institutions, than those in which it has been heretofore known and appreciated.

No pains have been spared in the revision and preparation of this Edition, with the hope of rendering it worthy, in every respect, of the high commendation and liberal patronage enjoyed by Mr. Kerney's Popular Class Books.

RECOMMENDATIONS, NOTICES, &C.

From PROFESSOR JOYNES, *of Washington and Lee University, Va.*

Messrs. JOHN MURPHY & Co., *Dear Sirs:*—I have used *Kerney's First Lessons in History* for some time past, in teaching my own children, and have had occasion at the same time to compare it with other books for the first study of History. I consider *Kerney's* much the best book for this purpose that I have seen. It is the most comprehensive, and at the same time the simplest in its style—while it is full of *facts*, it is also sufficiently enlivened by anecdote and incident, to keep up the interest of children. It seems moreover to be just and truthful, and contains nothing that could be offensive to any portion of our people—a quality that in these days, when school books seem to be regarded as proper instruments for political teaching, should commend it especially to the people of the South. I trust it may have a wide circulation in our Southern Schools. Very truly. EDWARD S. JOYNES.

EASTERN FEMALE HIGH SCHOOL, *Baltimore, June 26,* 1871.

GENTLEMEN:—The true province of the Historian is to give facts without comment. This is a distinguishing quality of Kerney's "First Book of History," which renders it not only a model for all compilers, but an unobjectional work for all schools. NATHANIEL H. THAYER.

MURPHY & Co., *Publishers and Booksellers, Baltimore.*

Kerney's First Class Book, Notices, &c., continued.

Messrs. J. Murphy & Co. **Baltimore, *May* 28, 1868.**

***Gentlemen*:**—I have carefully examined your new edition of the First Class Book of History, and I beg to express to you the satisfaction I have felt in its perusal. It is admirably adapted to the purpose of a text-book; the arrangement being such that it is calculated to fix in the youthful mind impressions rendered vivid by the easy, natural and interesting style of the narrative. As a practical evidence of my appreciation of the merits of this book, permit me to assure you of my determination to adopt it in my own school. **Henry Onderdonk.**

"A clear general knowledge of history may be received from this work without confusing such information with a mass of details and events of less importance. The book affords an excellent preparation for a more comprehensive field." *Vicksburg Herald.*

"We have examined this work attentively, and take great pleasure in commending it to general favor. The historic facts are set forth in the most concise manner, calculated at once to impress themselves upon the young mind, imparting solid information. Just enough, and not too much is placed before the juvenile student, to create a zest for further knowledge after laying this history aside. It is upon the inductive system, and wholly free from sectarian or political bias. A more suitable work could not, in our judgment, be placed in the hands of pupils, or prove more acceptable to schools." *Maryland Republican.*

"We hope to see this little Book introduced into general use in the Public Schools of our county." *Port Tobacco Times.*

"We have given it a full examination, and feel satisfied that its careful, concise, and attractive arrangement of historical facts must commend it to every practical teacher."—*Dental Journal.*

"Mr. Kerney has done his work well, and under the careful revision to which it has been subjected, this 'First Class Book of History' really deserves the high reputation which it has acquired." *Baltimore Gazette.*

"This little volume is a successful attempt of a Baltimore publisher, to furnish a School History worthy of the Public Schools of Maryland. The style is terse; its statements of facts are made with great clearness and impartiality. We cordially commend it to our School Commissioners, and hope they will not overlook it when they make their selection of text-books."—*Easton Star.*

"We have given the work some attention, and find it well written, simple and truthful. Its accounts of history from the beginning of time to the present are reliable. The book should and will find its way in our Public Schools." *Centreville Observer.*

"From a hasty examination, we adopt the opinion that it is exactly adapted to the wants of our Public Schools, as well as Academies and Seminaries generally." *Westminster Advocate.*

"The best evidence of the popularity of this 'First Class Book of History,' is the fact that this is the 32d edition, and upwards of 50,000 copies have been sold. The original work of Mr. Kerney has been greatly improved by Rev. J. S. Sumner, S. J., of Georgetown College, a gentleman thoroughly competent to the task, and who has bestowed a great deal of judicious care and critical labor in making it as perfect a compendium as possible. The aim of the author and editor evidently has been to cover a great deal of ground for beginners in history with a narrative clear, well connected, well fortified with dates, and illustrated with narratives and digressions suitable to interest youth; and with moral points to impress their minds at the same time that the narrative aims to be impartial. Its groupings in history are made to suit the exigencies of a progressive study of American children in the outlines of history. In this respect, we believe the book has no superior. In fairness and impartiality, it is in striking contrast with most of the popular school books of the day; and though this fact may detract from its merit in the eyes of the over-zealous, both in politics and religion, yet to the calm, the candid, and the reflecting of all parties, it will constitute a high claim to consideration, especially as adapting it to our common schools, where it is so important, and yet so difficult, to steer clear of religious and political prejudices of one kind or another." *Boston Pilot.*

To the School Commissioners of Charles County, Md.

***Gentlemen*:**—Permit me to direct your attention to a small work, just such as should be in all our schools. It is *clear, comprehensive, impartial,* and metes out even-handed justice alike to each section and every portion of our country. The work I refer to is *The First Class Book of History,* by M. J. Kerney, A. M., published by John Murphy & Co., Baltimore. Those whose prerogative it is to control the literature of our Public Schools, sustain a most responsible position; their influence will extend to generations yet to come upon the stage of action. This little work—little in bulk, in material dimensions, but vast in its range and comprehensive in detail—is of just such a character as ought to be adopted in all schools, both public and private, and that through the entire length and breadth of our country. But I apprehend that this most important character in all histories—I mean its exact, even-handed impartiality—will exclude it from some sections of our great country; and I apprehend also that to you this very trait of honest, open truth-telling will be its strongest recommendation. For what is history without truth but a fable, and what is distorted history but a lie? We all have had to lament the introduction of such historical works, without the power of redressing the wrong, as, to say the least, were partial, unjust, uneven, distorted, and often malignant.

E. REED, Glebe, *Trinity Parish, Charles Co., Md.*

A NEW SCHOOL HISTORY of MARYLAND.

Adopted as a Text Book in the Public Schools of Baltimore,

And Several Counties of the State.

A History of Maryland, upon the basis of McSherry's, for the Use of Schools. By **Henry Onderdonk**, A. M., *late President of the Maryland Agricultural College.* A neat and attractive volume, embellished with a fine likeness of **George Calvert**, First Lord Baltimore. 18o., half arabesque, 75.

This book has been compiled to meet an acknowledged want in our Schools, by a gentleman of long practical experience as a teacher, and of intimate connection with the educational interests of the State.

It has been a matter of regret that, with so much to make us proud of our history, so large a portion of a pupil's time should be devoted to the chronicles of countries and eras remote from us, to the exclusion of what so intimately concerns ourselves. With us, probably, this has been caused by the habit of depending upon Text Books imported from other States, and the consequent want of a suitable work. The universal favor with which this work has been received by the Press and the public, as attested by its introduction into the Public Schools of this City, and in several Counties of the State, and the sale of a large edition in a few months, is a gratifying evidence of its merits.

RECOMMENDATIONS, NOTICES, &C.

OFFICE OF THE COMMISSIONERS OF PUBLIC SCHOOLS,
Baltimore, September 24th, 1869.

This certifies that the Board of School Commissioners of this city, have inserted in the Rules of Order, as one of the studies to be pursued in the Grammar Schools, "McSherry's History of Maryland, as revised by Onderdonk." Attest: H. M. COWLES,
Adopted May 25th, 1869. *Sec'y Board School Commis'rs.*

From REV. GEO. F. BEAVEN, *School Commissioner for Caroline County.*

Messrs. JOHN MURPHY & Co. HILLSBORO, *September* 25, 1868.

Gentlemen:—I thankfully acknowledge the receipt, through your kindness, of a copy of "A History of Maryland" for the use of Schools, by Henry Onderdonk, A. M. A perusal of it has afforded me much gratification. Its accuracy of facts, its honesty in the statement of those facts, and the tone of its sentiments form a pleasing contrast to the religious and political biases and prejudices and vulgar tastes of so many histories that, hitherto, have been thrust upon the attention and study of Maryland youth. As one of a committee of two, I have been humbly instrumental in introducing this history into the schools of this county.

"This volume leaves nothing more to be wanted. It should be memorized by every child in the public schools of the State, that thereby may be laid the foundation for a more thorough study of more pretentious works of Maryland history. There is much in the history of our State to interest youths. As a general thing, we regret to say, there is a lamentable deficiency in a knowledge of Maryland history among our youths. They have studied Goodrich, which tells much about New England, but little about Maryland. It is time this thing was corrected, and our School Boards should do it. If it continues hereafter, the fault will be entirely theirs." *Easton Star.*

"An admirable book for schools, embracing a complete history of the State, from its settlement by Sir George Calvert, to the present day." *Home Journal.*

"In this excellent abridgement of McSherry's History of Maryland, Mr. Onderdonk has not simply contented himself with a condensation of that work, but has added new matter in it and has also brought the narrative of events down to the present day. All the main incidents in the history of the State have been carefully preserved. The style is clear and lucid, and the work well printed and bound. It is, in point of fact, just that sort of skeleton history which De Quincey so cordially commended to students as furnishing them with all that they need to know at first on the subject, leaving them to fill up the details at a later day from larger and more ambitious works. We cordially commend this abridged history of Maryland to the school authorities of this State." *Baltimore Gazette.*

"A GOOD BOOK.—It is a concise and clear narrative of events from the beginning of the proprietary government down to the time of the election of Governor Bowie. The accuracy and comprehensiveness of this condensation of Maryland history, and the correctness and dispassionateness of its record of events, render it a valuable addition to any library, and especially commend it as a standard text book for our schools, where it meets a want long felt."—*Balto. Sun.*

"We commend this work to all who desire to know the history of our State, from its earliest settlements to the present time. The style is clear and comprehensive, and the mechanical part of the work well executed. Though gotten up for the use of schools, it will be found of interest and advantage to all desiring a knowledge of the history of Maryland. We cordially recommend this history to our school authorities, and hope it will be adopted by the public and private schools of this county, and also by the schools throughout the State" *Eastern Shoreman.*

MURPHY & Co., *Publishers and Booksellers, Baltimore.*

Kerney's Arithmetics.

The Columbian Arithmetic, designed for the use of Academies and Schools. By M. J. Kerney, A. M. 25th edition. 50

The aim has been, in the compilation and arrangement of this work, to make it a book of *practical instruction;* one in which the science of figures is thoroughly explained and clearly elucidated. The examples for practice are generally such as the pupil will meet in the various business transactions of life. The arrangement is progressive, all questions being solved by rules previously explained. This new edition has been carefully revised and enlarged. Several useful tables on the subject of *Interest* have been introduced, and numerous miscellaneous examples added. These improvements will render the work still more deserving of the extensive patronage it has heretofore enjoyed.

Key to Kerney's Columbian Arithmetic, containing the solution of the principal questions 40

Introduction to the Columbian Arithmetic, for the use of Schools. By M. J. Kerney, A. M. 30th Revised Ed...... 20

This little work is designed as an introduction to the former, and is intended for children about to commence the study of Arithmetic. The first principles of the science are familiarly explained in the form of question and answer, and the pupils are conducted in the study as far as the end of compound numbers. It is replete with practical examples, adapted to the capacity of that class of learners for which it is designed, and it also contains all the *Tables.*

Mr. Kerney's Arithmetics have already acquired a wide-spread popularity, as attested by the sale of large editions in a few years. They are books of practical instruction, arranged by a practical teacher of many years experience. The present editions have been carefully revised, and neither pains nor expense will be spared to render them at all times worthy the high reputation already acquired.

The Publishers have the pleasure of announcing that this Series of Arithmetics have undergone a *careful* and *thorough revision,* by a Brother of the Society of the Holy Cross, an experienced practical teacher and arithmetician.

These Works have already acquired a Standard Reputation, as ranking amongst the most practical, systematic and best books of this class published.

Kerney's Murray's Grammar.*—An Abridgment of Murray's Grammar and Exercises,* designed for the use of Academies and Schools; with an Appendix, containing Rules for Writing with Perspicuity and Accuracy; also a Treatise on Epistolary Composition. By M. J. Kerney, A. M. 37th edition, 18o. hf. bd. 25

This Grammar is used in the Public Schools of Baltimore; in the Schools of the Christian Brothers; and in many of the principal Schools and Academies throughout the country.

In point of arrangement, this work is superior to any other Abridgment of Murray's Grammar that has yet appeared before the public. It combines the Grammar and Exercise, by adapting Exercises to every chapter and section throughout the work, so that the pupil may have, at every stage of his progress, a practical illustration of the portion under his immediate study. The present edition has been carefully revised by the author, and many valuable improvements made in the work. A Treatise on Epistolary Composition has been added, containing directions for writing Letters, Notes, Cards, &c., with a variety of examples of the same.

BRIEF EXTRACTS FROM NOTICES OF THE PRESS.

"This abbreviation of the large and unwieldy volume of the Patriarch of Grammarians has been effected without the omission of any important matter. It must find favor in schools." *Ball. Pat.*

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Murphy & Co. *Publishers & Booksellers, Baltimore.*

Kerney's Scripture History, &c.

A Catechism of Scripture History, compiled by the Sisters of Mercy for the Children attending their schools. Revised by M. J. KERNEY, A. M. 20th Edition........................ 75

"This excellent work is extensively used in nearly all Catholic institutions throughout England, Ireland, Canada, and the United States.

"The object of the Catechism, 'is to render children early acquainted with the truthful and interesting events recorded in the Sacred Scriptures; to familiarize them with the prophecies relating to the coming of the Messiah, and lead them to regard the Old Testament as a figure and a foreshadowing of the New.'

"The present edition has been much improved, the questions to the answers being made more concise, so as to admit of their being easily committed to memory. An appendix has also been added, containing extracts from the Prophets, Scripture texts, and short sketches of the lives of the Apostles and Evangelists. The Chronological Table, which has been carefully revised and considerably enlarged, fixes the dates of the most remarkable events recorded in the Sacred Writings.

"We hope soon to see this book introduced into all Catholic Schools in the British Provinces, and were its merits known, we are certain it would meet with a circulation similar to that which it has acquired in England and the U. S." ***Halifax Catholic.***

"Of the merits of the book itself, it would be superfluous to speak; the labors of the American editor have added very considerably to its value." ***Metropolitan.***

"It is an admirable book for schools, and calculated to give a far more vivid and lasting knowledge of sacred history than could be obtained from years of desultory and mechanical 'Bible-reading.'" ***Detroit Vindicator.***

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This little work has been carefully revised and enlarged, the text being brought down to the present time. These improvements it is hoped will render it still more popular with the in structors of youth

Murray's English Grammar, adapted to the different classes of learners; with an APPENDIX, containing rules and observations for assisting the more advanced students to write with perspicuity and accuracy. By LINDLEY MURRAY. 12o.... 40

In presenting a new edition of Murray's Grammar, which is universally considered the best extant, we deem it sufficient to state, that the present edition is printed from an entirely new set of plates, and that it has been carefully revised, and free from many of the inaccuracies and blemishes which are to be found in other editions, printed from old stereotype plates. This, together with the very low price affixed to it, are the only claims urged in favor of this edition.

Murray's English Reader..............................18o. 35

The North American Spelling Book. Designed for Elementary Introduction in Schools. A New Enlarged Edition. Being an improvement upon all others............................ 20

The aim in this compilation has been to present a gradation of lessons necessary to impart a knowledge of the spelling, division, pronunciation, and accentuation of the various sounds and syllables that compose the English language. In pronouncing and accenting words, good usage and the best lexicographers have been followed The rules laid down are few, but simple and concise; and the progress from what is easy to what is difficult, is gentle and gradual. It is universally conceded to be one of the BEST, as it is unquestionably the ***Cheapest Spelling Book published.***

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The main object of this treatise is to render the science of Algebra intelligible to pupils whose minds are yet unaccustomed to such studies. The beginner will here be furnished with such proofs as are suited to his capacity; examples will afford new light to what might be otherwise obscured with regard to the operations founded on higher principles; he will, for the present, content himself with merely practical rules, exemplified in the same manner. With a mind thus gradually led on to strict mathematical discussion, he may then resume his course with profit, by the aid of a treatise now in preparation, which is intended as a sequel to this, and, by more exact and thorough investigation, complete his study of Algebra.

Brief Extracts from Notices of the Press.

"This work recommends itself to favor by the admirable order of its parts, and the conciseness and clearness with which its principles are expounded. One needs but open the book to perceive that the author has brought to the execution of his task a ripened judgment and well-tried experience. He is not a compiler—his work has the rare merit of originality, and every student of Algebra will thank him for having given in a few pages what has usually occupied a large volume, and for having rendered intelligible what has often proved an enigma to many." *Metropolitan.*

"This book might very properly be called 'Algebra without a master.' One very important improvement that the author has made upon all our text-books, and which deserves to be mentioned, is this, that he keeps monomials and polynomials *distinct*, and explains and applies to them separately the various rules as laid down in his Algebra. The work only wants to be known, in order to be universally approved." *Western Tablet.*

"We feel much pleasure in recommending it as containing nearly all necessary to be known on the subject of which it treats. It is eminently adapted for the use of young persons who wish to acquire a knowledge of the difficult science of Algebra." *Halifax Catholic.*

"As a rudimental book it will be found eminently useful in schools and colleges." *Detroit Vindicator.*

"The author is well known as a man of great ability, and his work cannot fail to be of good service in schools." *Buffalo Sentinel.*

A Treatise on Algebra, by B. Sestini, S. J., author of "Elementary Algebra," "Analytical Geometry," &c. 12o, 1 00

"We have had occasion before to speak of the works of Professor Sestini, and the commendation we then bestowed upon them we have no hesitation in repeating now on this new work, which has issued from his indefatigable pen. The best praise, however, in these matters, is experience, and that this is in his favor is evident from the necessity of publishing a second edition of his Elementary Algebra. This shows that he has the proper manner of communicating knowledge on that abstruse study, and should be an 'a priori' recommendation to this larger treatise on the same subject. It is as clear and concise as the nature of such works permits, and seems to embrace everything necessary to a full knowledge of Algebra. But let the author himself speak. 'The treatise is divided into two parts, the first of which contains Algebraical operations, with several questions and doctrines connected with them, so that each section may prove complete in its own subject, and the inconvenience of turning elsewhere to speak of matter left unfinished before, may be avoided. . . . . The second contains the most indispensable theories of equations, proportions, and progressions, logarithms, and some few principles on the series. The doctrine of equations has been treated more copiously than the others, not so much on account of its importance as because it is well adapted to give an idea of algebraic analysis, and thus prepare the mind of the student, who would afterwards apply himself to higher studies.'" *Metropolitan.*

Elements of Geometry and Trigonometry, by B. Sestini, S.J., Author of "Analytical Geometry," "Elementary Algebra," &c. 8o. half cl. $2

"The author has succeeded in combining two qualities rarely united,—great perspicuity and extreme conciseness. It has evidently been the result of great thought and long experience in teaching. The student passes gradually from the simpler to the more complex truths of the science. The work cannot be too warmly commended as an admirable introduction to the science it professes to teach, and we would advise teachers and parents not to select a text-book until they have given this volume a careful and candid examination."—*Metropolitan.*

"We consider it a most valuable addition to the elementary literature of mathematics. The style of the author is clear, his method at once brief and rigorously exact, and his explanations and statements remarkably perspicuous. We cannot too highly recommend the work, and must say, that, though there may be no royal road to Geometry, this comes nearer to that easy route than any book we have seen." *Baltimore Patriot.*

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"Works of analysis—some of them voluminous—are not wanting; nor does our little book pretend to give a complete development of its subject. For this reason we call it a manual, which excludes all discussions the results of which are seldom or never called into use in the applications. It is hoped, however, that it will sufficiently serve the purpose intended."

GREEK AND LATIN GRAMMARS, &c.

Wettenhall's Greek Grammar.—*Rudiments of the Greek Language,* arranged for the Students of Loyola College, Baltimore,—upon the basis of Wettenhall. 6th. ed. 12o....... 75

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"We commend it most heartily to those who wish to study that most perfect of all human languages, as the shortest and readiest way to smooth all their difficulties."
Metropolitan.

Ruddiman's Latin Grammar.—*Ruddiman's Rudiments of the Latin Tongue;* or, a Plain and Easy Introduction to Latin Grammar: wherein the principles of the language are methodically digested, both in the English and Latin. With useful Notes and Observations. 30th edition—corrected and improved. By William Mann, M. A. 12o, half arabesque...................... 75

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This book has been prepared with great care by a gentleman eminently qualified, both by education and experience. Its characteristic is the simplicity of its arrangement. Being strictly a Spelling Book, no attempt is made to combine with it subjects of study coming, properly, *after* the child has learned to spell and read. Each lesson is accompanied by a Reading and Dictation Exercise, designed to cultivate the eye, the ear, and the hand. The object of a Speller being to teach the mechanical structure and pronunciation of words, the lessons and exercises are arranged primarily and solely to this end. The orthography and orthœpy are according to the standards recognized as highest authorities in this country. Especial care has been taken to keep it free from *provincialisms*, and it is, therefore, recommended as a Text-Book suitable alike for all sections of the country. The completeness of its vocabulary may be known from the fact of its containing upwards of twelve Thousand English words.

RECOMMENDATIONS, NOTICES, &C.

STATE OF NORTH CAROLINA, OFFICE SUPERINTENDENT OF PUBLIC INSTRUCTION,
RALEIGH, May 20th, 1871.

MESSRS. JOHN MURPHY & CO., *Gents*—I have the honor to inform you that, by virtue of a vote passed by the Board of Education of this State, on the 25th of March last, "Wilson's Progressive Speller" is recommended for use in the Public Schools of this State.

Yours truly S. S. ASHLEY, *Sec'y of Board*.

From* REV. C. H. WILEY, *Superintendent of Common Schools of N. Carolina.

Mr. W. J. WILSON: *Dear Sir*—I have examined with care your Spelling Book, and regard it as a book of decided merit. You have manifested in its preparation taste, judgment and learning, and I consider it worthy of introduction into our schools. I am truly yours, C. H. WILEY.

From* REV. B. CRAVEN, D. D., *President of Trinity College, N. C.

Mr. WILSON: *Dear Sir*—I have examined your Spelling Book, and believe it in many respects superior to any with which I am acquainted. It is full of important improvements. I should be glad to see it introduced into all our schools. B. CRAVEN.

From* REV. DR. DEEMS, *of N. Carolina.

Dear Sir—The pressure of my engagements has not allowed time for a very careful examination of the MS. of your Spelling Book, the many good points of which have made themselves apparent to the Rev. Dr. Craven and the Rev. Mr. Wiley, whose judgment of such a work I am free to endorse. I hope it will meet with deserved success. Very respectfully yours,
W. J. WILSON, Esq. CHARLES F. DEEMS.

From* PROFESSOR JOYNES, *of Washington and Lee University, Va.

Messrs. JOHN MURPHY & CO., *Dear Sirs*—I regard *Wilson's Progressive Speller*, published by you, as the best Spelling Book that I have ever seen. In simplicity, in fullness, in well distributed and well graded classification, and in practical convenience for use, I think it superior to other books. The *Dictation Exercises* that accompany the spelling lessons, afford a useful praxis for the pupil. I like the book most of all on account of its *simplicity* and *easy progressiveness*. It recognizes the old truth—almost forgotten now-a-days—that spelling is something not only worth learning, *but very hard to learn*, and therefore needed to be taught by systematic, constant, and well-graded practice; and of this, it furnishes more, and furnishes it more judiciously, than any other book that I have seen. I wish it may obtain a very wide use.
EDWARD S. JOYNES.

"The work is systematic, devoid of provincialisms, arranged with strict regard to gradation with a uniformity of all the leading vowel sounds in all the words of each lesson. The classification is admirable, and we believe the work will be approved by teachers everywhere."
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MURPHY & CO., *Publishers and Booksellers, Baltimore.*

"Mr. Wilson is a North Carolinian, and has turned his attention to school books, and in th present volume has certainly given evidence of his decided ability. We like it chiefly for it simplicity, not being one of those hybrids of speller, grammar and dictionary, which are a nui sance to all trying to use them; and, as it is, moreover, a Southern school book, we recommen it to the public alike for its merits and its origin." *N. Orleans Times.*

"This is a marked advance upon preceding "Spellers," fully calculated to accomplish wh is claimed for it." *N. Orleans Picayune.*

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